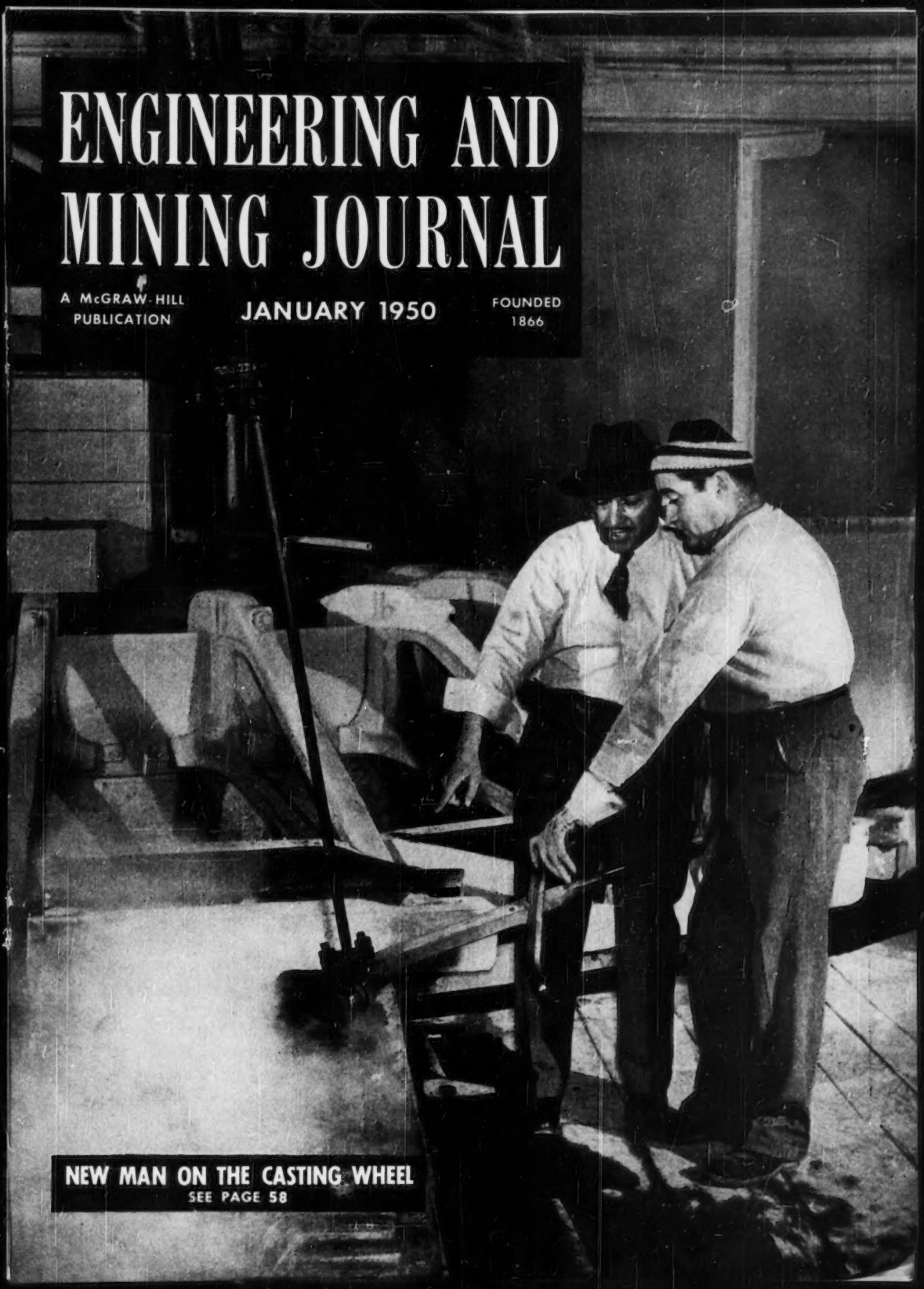
ENGINEERING AND MINING JOURNAL

A McGRAW-HILL PUBLICATION

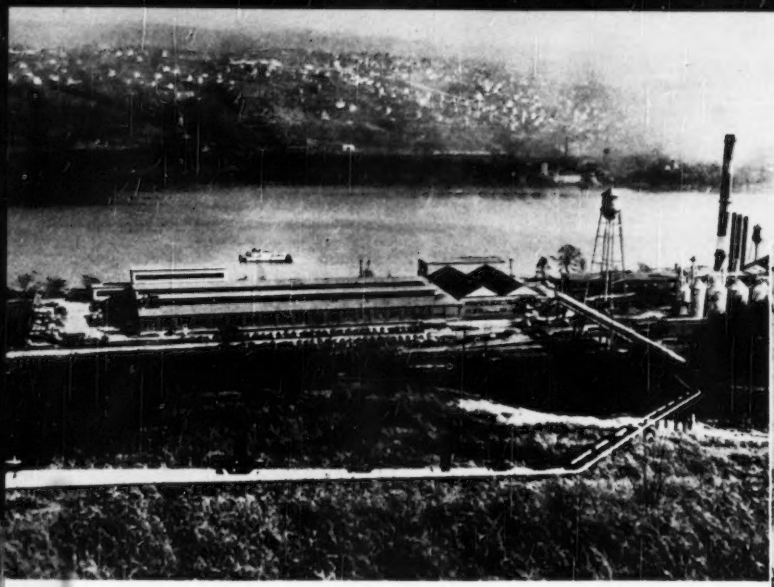
JANUARY 1950

FOUNDED 1866

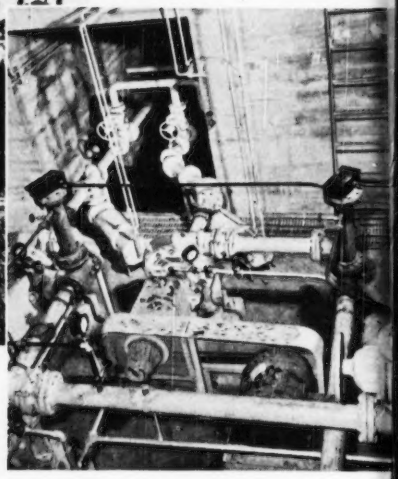


NEW MAN ON THE CASTING WHEEL

SEE PAGE 58



This view of the plant far below gives an idea of the head and long distance involved, and the piping runs still further than shown here.



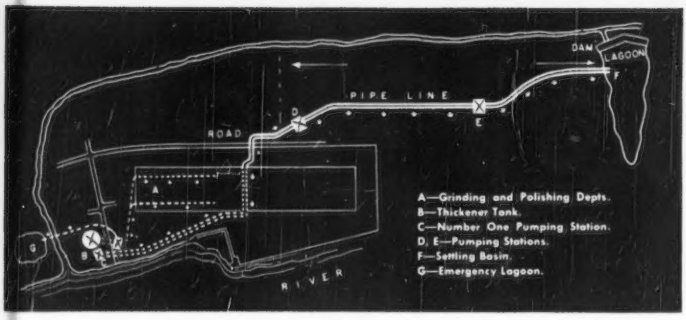


Diagram at left shows entire pumping system. Waste comes from A to thickener, B, then to three pumping stations, C, D, E, and settling basin, F. There are actually two systems, one the duplicate of the other. Hydroseals are in series, two in each station for each system. All pumps are operated by remote control with automatic start and stop. Since piping is cross connected, discharge can be automatically switched from one line to the other or just part of the other. Above photo shows one of the Hydroseals in the first pumping station.

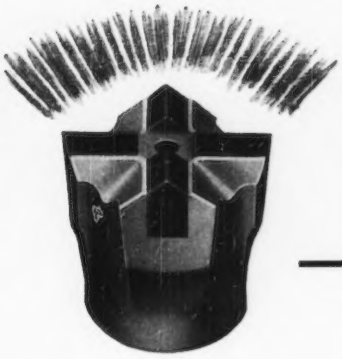
SLUDGE PUMPED *Over the Hill and a Mile Away*

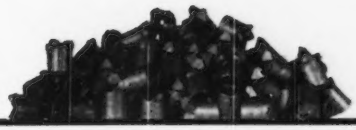
A large Eastern manufacturer had a problem in materials pumping when they planned a system to divert waste from an adjacent river in a state-wide program to eliminate stream pollution. The problem involved pumping highly abrasive sludge to a point high above the plant and more than a mile away. They needed a pumping system that not only could handle hundreds of tons of sludge a day but also one able to resist the abrasive action of sand, emery, rouge, plaster, felt and iron grindings from the grinding and polishing operation. Hydroseals were selected to do this difficult long distance, abrasives pumping job . . . similar to numerous others where they have been proved successful and economical. Thus, this accomplishment becomes still another example of how Hydroseals can solve abrasive materials pumping problems. How about yours? Write for Catalog. The Allen-Sherman-Hoff Company, 229 S. 15th Street, Philadelphia 2, Pa., U. S. A. Representatives in Most Principal Cities.

HYDROSEAL SAND, SLURRY & DREDGE PUMPS
MAXIMIX RUBBER PROTECTED

HYDROSEAL, PACKLESS AND MAXIMIX DESIGNS ARE COVERED BY PATENTS AND APPLICATIONS IN THE MAJOR MINING CENTERS OF THE WORLD

One CARSET JACKBIT does the work of more than 100 steel bit uses





CARSET ADVANTAGES

- Practically eliminates bit changes
- Drills longer steel changes without binding
- Saves up to 30% on dynamite

These are the proven facts about CARSET JACKBIT performance and economy—based on thousands of actual field reports like those given below.

In nearly all cases CARSET JACKBITS have drilled *at least* 100 times as much hole footage as a steel bit usage — in many cases, 300 or 400 times as much. The footage that you can drill with one CARSET JACKBIT would therefore require 100 bit changes if steel bits were used. And because gauge-wear is negligible, even in abrasive rock, CARSET JACKBITS can drill the longest practical steel changes without binding. They drill uniform-diameter holes to any practical depth, saving up to 30% on dynamite costs alone.

But this is only part of the story. For full information on CARSET JACKBITS — what they have done for others, and what they can do for you, write today for your copy of catalog No. *4091.*

CARSET JACKBIT

THE IR SUPER-BIT

SET WITH CARBOLOY INSERTS

manufactured exclusively by

Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y.

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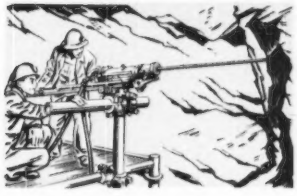
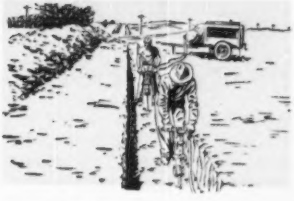


A MINING COMPANY, driving a 12 by 20 foot, 97-hole heading in hard taconite, pulled 6½-foot rounds in 18.5 hours with CARSET JACKBITS, compared to 5-foot rounds in 49.8 hours with steel bits. Actual cost with steel bits was $142.56 per foot of drift. With CARSET JACKBITS, the cost was $49.77 per foot — a saving of $602.48 per round!

ON A LARGE ROAD JOB, a contractor used 125 CARSET JACKBITS. His total cost for bits and rods was $2,008. He estimates, that with steel bits, his bit and rod cost would have been at least $7,500! His saving on bit and rod cost alone, therefore, amounted to $5,492 — about $43.00 for each CARSET JACKBIT used.



A CONTRACTOR on a large sewer project, drilling with J-50 Jackhamers in hard, dense basalt, was able to average only one foot of hole per steel bit, at a bit cost of approximately 15 cents per foot of hole. Now, with CARSET JACKBITS, he is averaging 260 feet per bit, at a bit cost of 5¼ cents per foot of hole — a saving of 66% on *bit costs alone.*

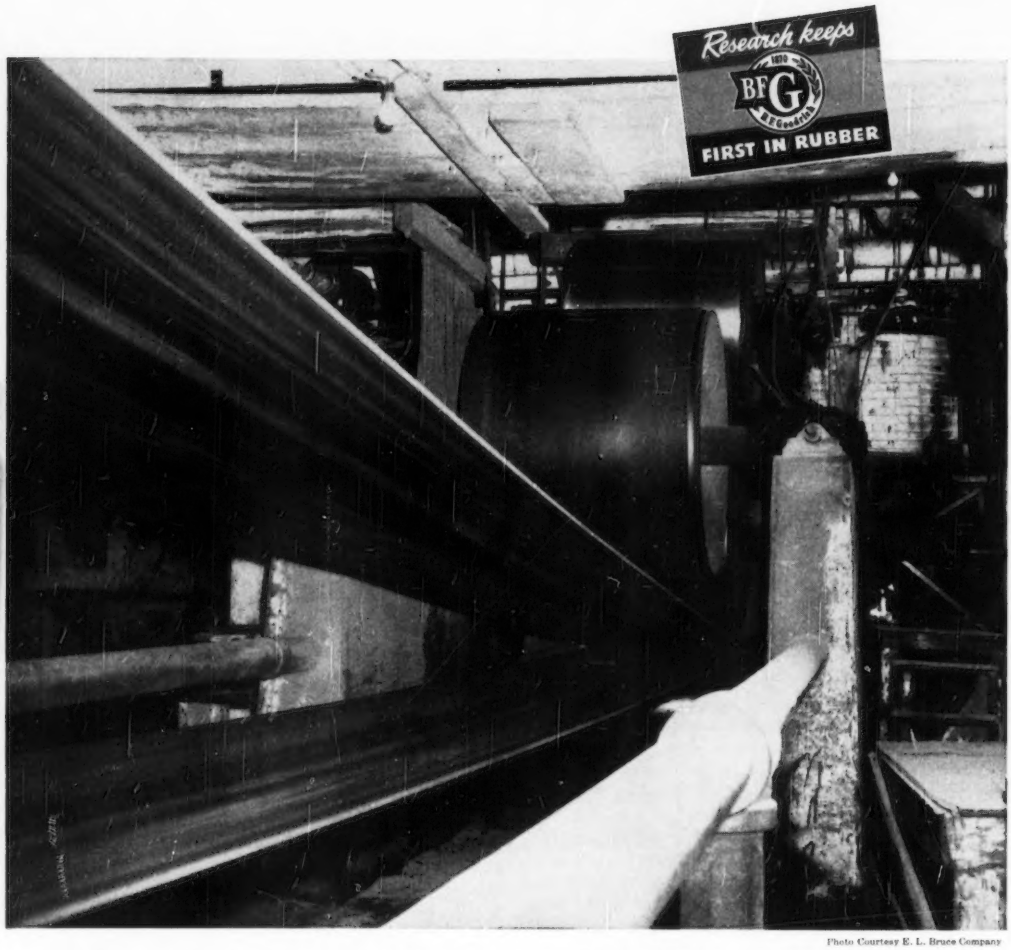


Photo Courtesy E. L. Bruce Company

They wanted a rubber band that would not stretch

A typical example of B.F.Goodrich product improvement

IF YOU think all rubber is alike, take a look at that 80-foot-long rubber band "worth its weight in gold" because it *will not* stretch.

That belt drives all the machinery in the world's largest wood flooring mill. It used to be a leather belt but that stretched so badly it had to be re-glued every 30 days. Too expensive; too much trouble.

Someone suggested a rubber belt — but wouldn't a rubber belt stretch even more? Not the way B.F.Goodrich makes it. Our engineers had developed a belt so strong it rarely stretches and then invented a way to lock belt ends together (Make a belt endless, it's called) with a splice which never tears loose. Belt users say it ends 90% of all belting troubles and failures, makes belts last many times as long on many drives.

In the flooring mill, the belt in the picture has been in use 5 years.

Not once has it needed any attention nor repair; it has not stretched at all.

For long uninterrupted belt life, for constant machine operation with no delays for belting failures, the B.F. Goodrich Plylock Splice, as it is well named, has no equal. Your B.F.Goodrich distributor can make belts endless in your plant on the drive, or he can show your own employees how to do it. Call him. *The B.F.Goodrich Company, Industrial and General Products Division, Akron, Ohio.*

B.F.Goodrich
RUBBER FOR INDUSTRY

ENGINEERING AND MINING JOURNAL

84th YEAR OF PUBLICATION

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It's got what it takes *for the jobs that you've got*

OVERBURDEN or pay material—ore or coal—long hauls or short . . . here's a hauling unit that isn't choosy about the kind of work you give it. All it wants is to keep busy. With *power, ruggedness, dependability* and *big capacity* it will roll up for you great records on low-cost hauling.

It's a "Caterpillar" DW10 Tractor and matching Athey PD-10Q rock trailer that can move 15-ton loads of rocky stuff at a 24.5-mph. clip. On the job pictured below an average of six 8400-foot round trips are being made per hour—representing a total of about 720 tons of shot rock per 8-hour day.

If interested in greater profits through—

Fast stripping
Increased ore or coal production
Multiple-job hauling for full-time usage
Low fuel costs and easy operation

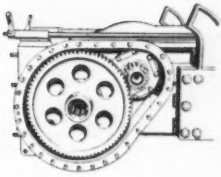
—you just can't beat an outfit like this. Behind it are a responsible manufacturer and a widespread, splendidly equipped dealer organization that can provide quick and efficient service at reasonable cost no matter where your jobs or headquarters are located. See your "Caterpillar" dealer. Meantime, USE THE COUPON—*now.*

CATERPILLAR TRACTOR CO. • PEORIA, ILLINOIS

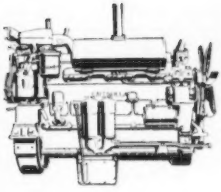
NOTE. *DW10s are also available with matching "Caterpillar" W10 Wagons and No. 10 Scrapers.*

Look under the hide

OF THE "CAT" DW10

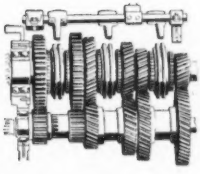


SPEEDS UP TO 24.5 MPH. Three complete ranges of speed are available with a choice of final drive gears. Many operators keep all three sets in stock to fit their DW10s to the job, ground conditions or haul distances. Differential-type rear end, combined with steering brakes, enables the DW10 to "walk" through soft spots on the fill. Full-floating drive axles are an assurance of dependable performance under the roughest of conditions.

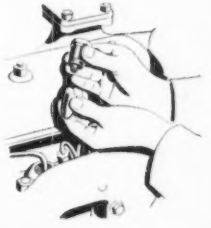


ALL-"CATERPILLAR" BUILT. Undivided manufacturer responsibility! Engine, transmission, clutch and final drive—all are 100% "Caterpillar" built and designed for each other. The engine, 115 honest horsepower, is known the world over for its dependable and economical performance. Its own independent gasoline starting engine is itself started electrically, or can be started by hand in case of battery failure. The engine is the heart of your operations . . . use the best.

EASY SAFE OPERATION. One way to get high earthmoving production is to design equipment for safety and ease of operation. Four-wheel stability; hydraulic booster steering; selective-acting air brakes on the DW10 and trailed unit; hydraulically controlled spring-mounted seat and unexcelled visibility—these add up to all-important reasons why operators prefer DW10s.



QUALITY BUILT. Typical of the quality designed into the DW10 is the constant-mesh, easy-to-shift transmission. A gear-type pump forces oil over the upper shaft to lubricate effectively the transmission on any grade. To insure long life, a large replaceable filter element guards against destructive abrasive materials. Just one of the many features that can boost production for you.



EASY TO MAINTAIN. "Caterpillar" has always designed for ease of service. Fuel injection equipment that can be replaced like spark plugs, with no adjustments required; a metallic-lined double-disc flywheel clutch that can be removed without disturbing engine or transmission—these are just two of many reasons why owners report full satisfaction. Hundreds of well-equipped "Caterpillar" dealers, each within easy job distance, constitute another reason why DW10s boost hauling profits.

CATERPILLAR

REG. U. S. PAT. OFF.

DIESEL ENGINES

TRACTORS

MOTOR GRADERS

EARTHMOVING EQUIPMENT

CATERPILLAR TRACTOR CO.

Dept. EM-1, Peoria, Illinois

Please send me your latest booklet, "The 'Caterpillar' Diesel DW10 in Action."

Name _____

Address _____

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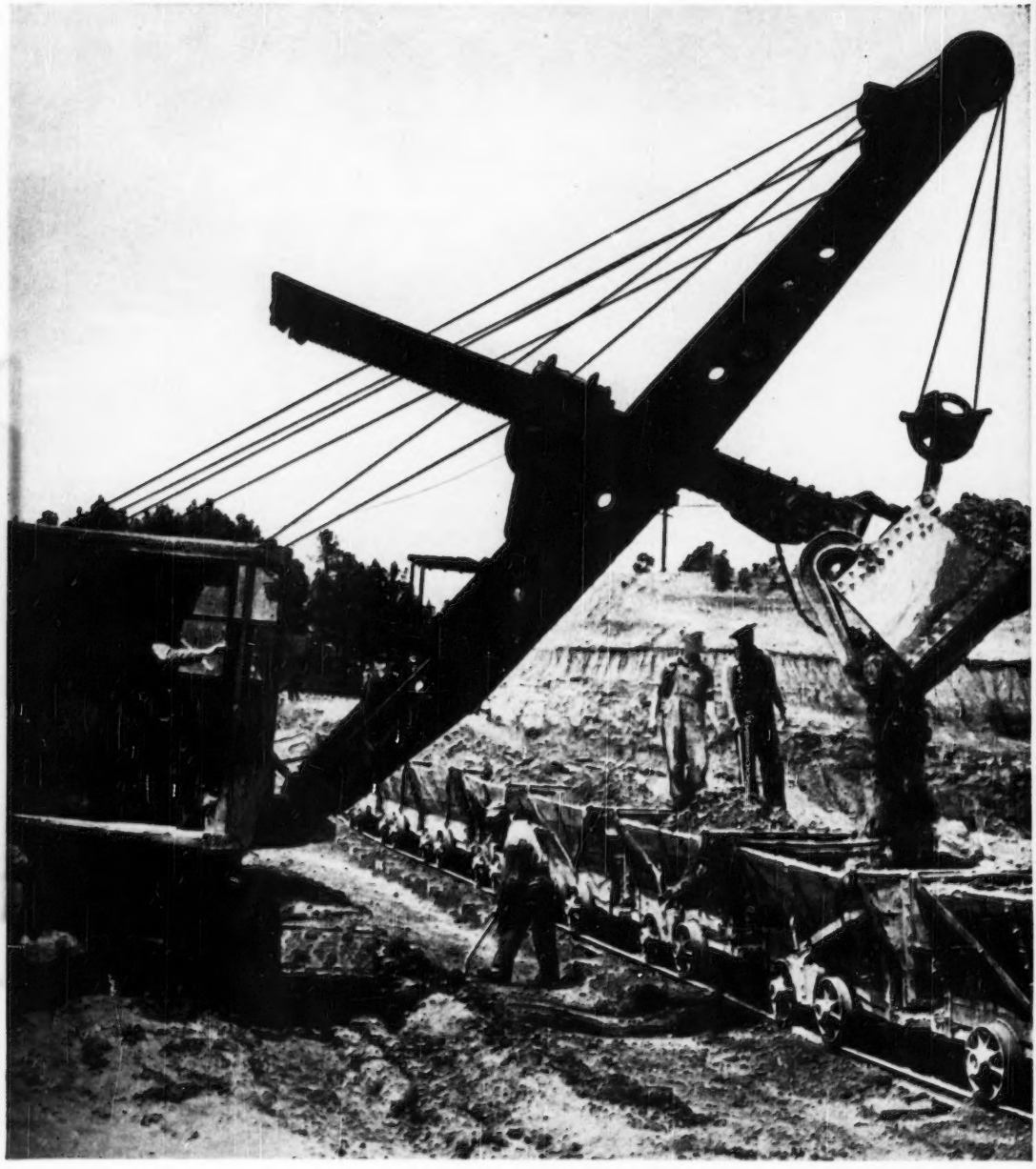

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on television
every Tuesday night.
METROPOLITAN OPERA
radio broadcasts every
Saturday afternoon.

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LONGER LIFE ... LOWER UPKEEP COSTS

for open gears and wire rope

Use TEXACO CRATER

THE easy-to-apply lubricant for open gears is *Texaco Crater X Fluid.* Just brush, spray or pour it on. No heating required, winter or summer. This is the famous *Texaco Crater,* for years the most widely used open gear lubricant, now made fluid for convenient application. Once applied, the thinner evaporates quickly, leaving gear teeth coated with a tough, adhesive film that absorbs heavy loads and shocks, reduces wear and noise, lasts a long time.

To keep wire rope strong longer, lubricate with *Texaco Crater A.* It penetrates – protects the hemp core and guards the metal strands against rust, dirt and wear. *Texaco Crater A* is long lasting and easy to apply.

Lubricate all types of mine car wheel bearings with *Texaco Olympian Grease.* This long-lasting lubricant reduces "drag" in starting and running . . . remains effective even at low temperatures. Trains start easier . . . maintenance costs come down.

Let a Texaco Lubrication Engineer help you simplify your maintenance lubrication procedures and reduce costs. Just call the nearest of the more than 2,000 Texaco Wholesale Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

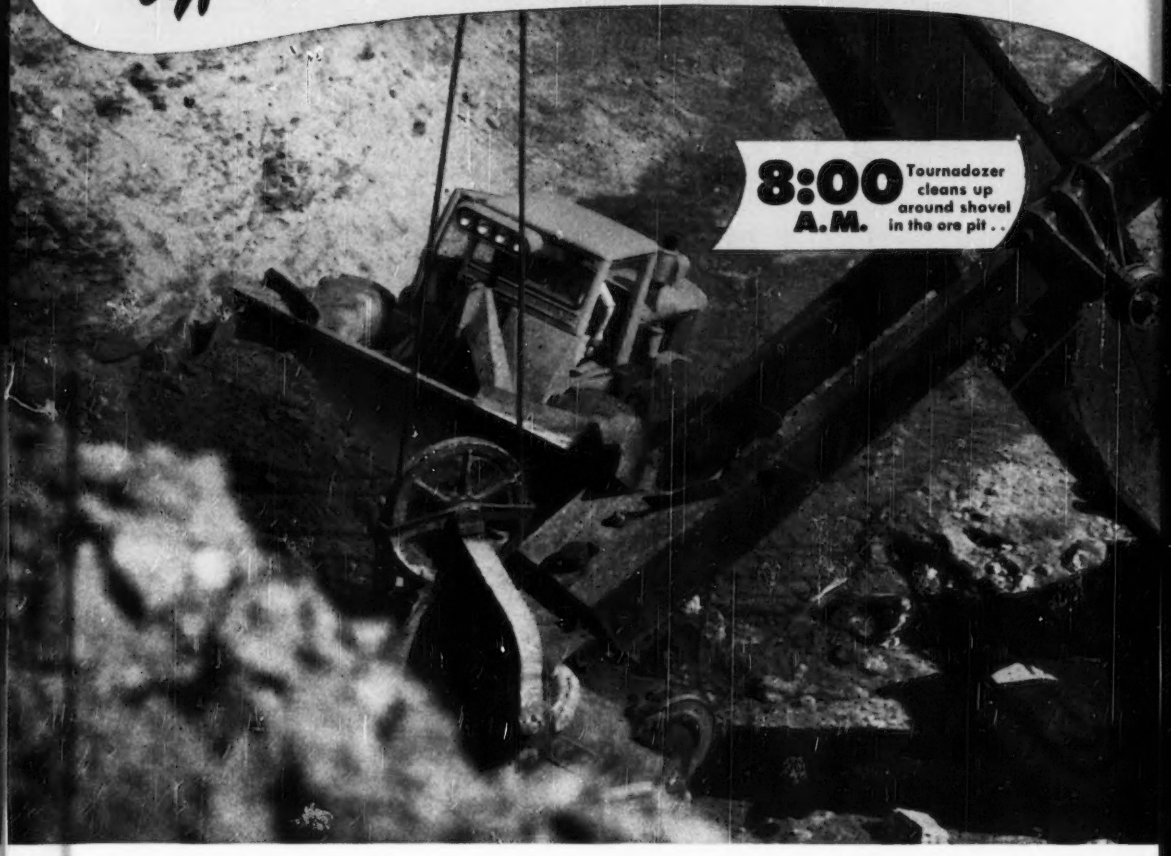
★

More copper mining equipment in the U. S. is lubricated with TEXACO than with any other brand.

Lubricants and Fuels

FOR THE MINING INDUSTRY

Here's a typical TOURNADOZER



AT Biwabik, Minnesota, Stanley Mining Company operates an ore pit, crusher, and washing plant 24 hours a day, 7 days a week. They are mining heavy rock, mixed with banded taconite, which must be crushed, screened, then processed to recover iron ore. On this multi-handling operation, they have a lot of widely-scattered dozer jobs . . . and have found the answer in a LeTourneau high-speed, rubber-tired Tournadozer. Above photos show how its fast, "run-about" ability helps Stanley Mining Company maintain steady, balanced production of pit and plants.

Tournadozer's principal job is handling clean-up around the ore shovel. It utilizes normal waiting periods to maintain the rock dump . . . cleans spillage at the crushing plant . . . feeds material from surge pile to hopper. Tournadozer gets there, gets each job done, and gets back to shovel FAST. It's also readily available at a moment's notice to clean second-growth timber ahead of a self-propelled rock drill . . . "lends a hand" whenever the crusher plant crew makes screen adjustments . . . builds and maintains haul roads.

With Tournadozer's faster-than-crawler speeds, in both forward and reverse, you, too, can get more work done, at lower cost per job. Let your LeTourneau Distributor show you how one Tournadozer can do the work of 2 to 3 conventional crawler dozers on your jobs. Write, or call TODAY.

R.G. LeTOURNEAU EQUIPMENT

To: **R. G. LeTOURNEAU, INC.,** Peoria, Illinois *Send us more Tournadozer information:*

☐ specifications ☐ job performance reports ☐ would like job analysis on our work

NAME..... TITLE.....

COMPANY..... TYPE BUSINESS.....

STREET..... CITY..... STATE.....

Type of work to be handled:.....

Also interested in ☐ 25 m.p.h., 7-yd. D Tournapull ☐ 30 m.p.h., 13-yd. C Tournapull ☐ rear-dump Tournar..xers ☐ bottom-dump Tournahoppers

8-HOUR SHIFT at Stanley Mining Co.

8:48 Travels .4 mi. to the crusher, cleans up drain spillage

11:55 Feeds material from surge pile to hopper at crushing plant

9:25 Runs .2 mi., and levels taconite-rock dump . . .

12:20 Speeds .2 mi. back to rock dump for more leveling . . .

9:34 Returns .6 mi. to pit for more clean-up at the shovel

12:25 Drives .6 mi. to pit, cleans up again around shovel . . .

11:45 Drives .4 mi. to help crew adjust screen at crusher

Tournarotor, Tournahopper Trademark Tournadozer, Tournapull-Trademark Reg. U. S. Pat. Off.M-21

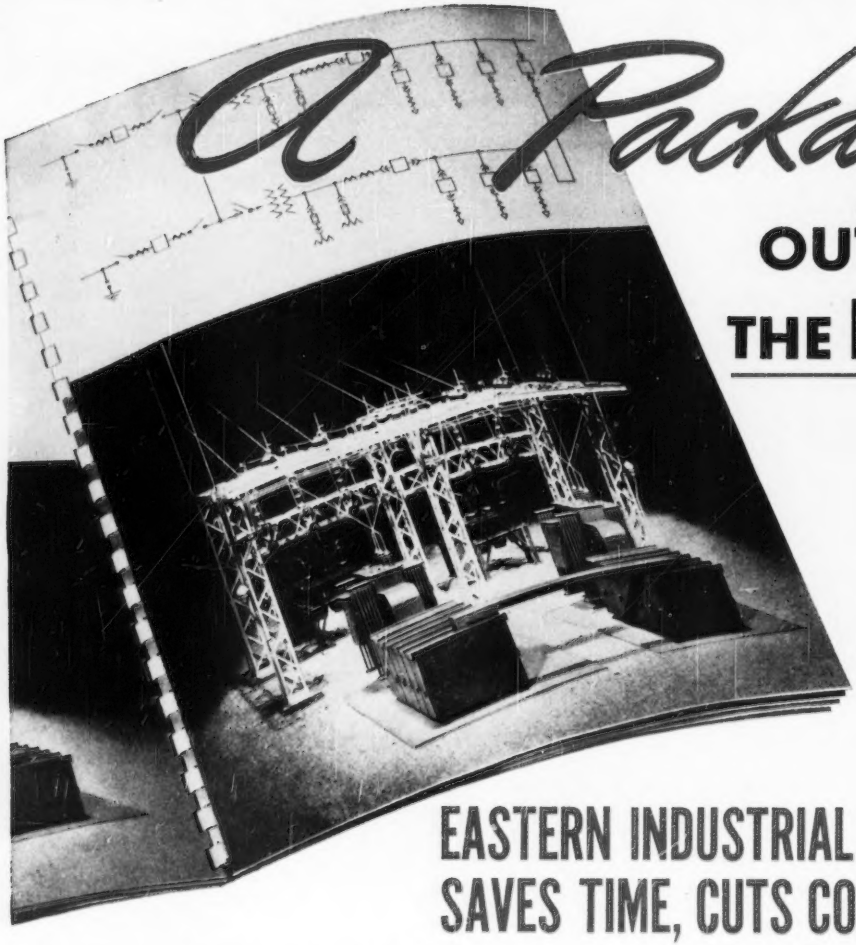
3:45 P.M. Goes .4 mi. to surge pile, feeds hopper. Next shift, 4:00 to 12:00.

LETOURNEAU PEORIA—ILLINOIS

JOB-PROVED Over 6,45 Built and Shipped

TOURNADOZERS

IT'S RUBBER THAT PUTS THE ACTION IN TRACTION



A Package OUT OF THE BOOK

EASTERN INDUSTRIAL PLANT SAVES TIME, CUTS COSTS,

BY ORDERING COMPLETE OUTDOOR SUBSTATION *As a Unit*

A *complete* package substation, plus *complete* factory-assembled load-center units for indoor distribution, gave this new plant a power system having the two vital requirements they could get in no other way.

Quick, easy ordering and installation

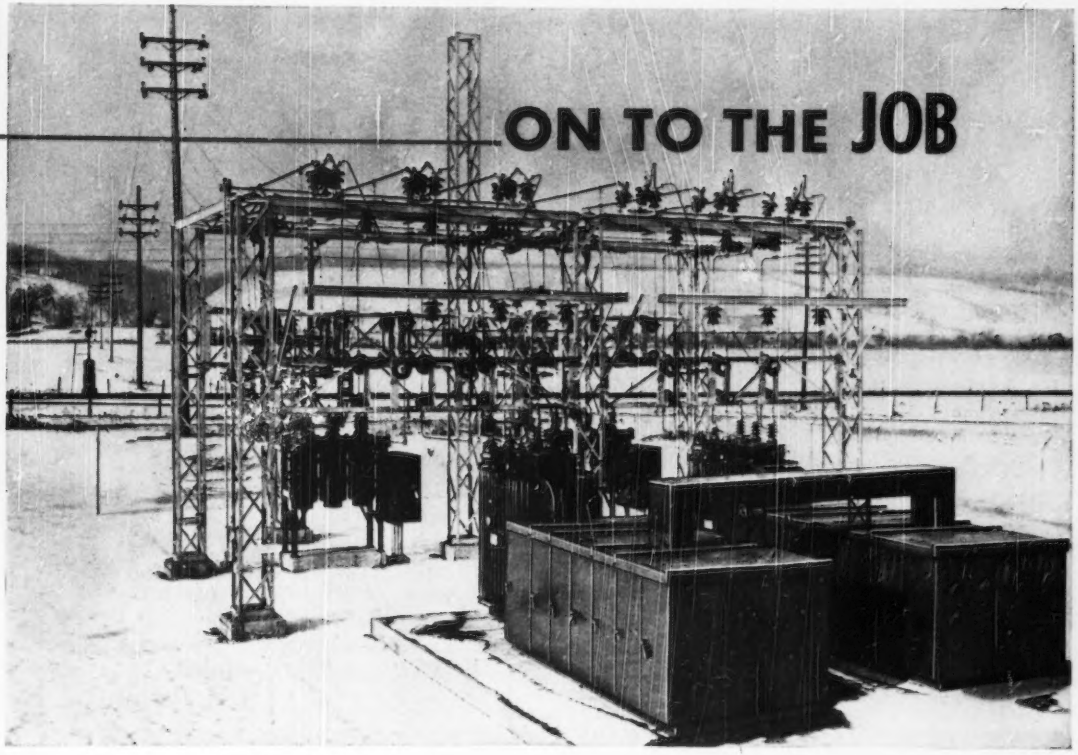
Only one set of specifications and one order were needed for *all* the equipment comprising the package substation. The same was true for the load-center units. The long delay and high cost of ordering the substation components piecemeal were eliminated. Installation was made simple and easy, too—the substations were shipped in factory-assembled sections as large as shipping facilities permitted.

Exceptional assurance of power continuity

This plant's operations are such that a power interruption would likely be extremely costly. Unusual precautions were warranted to assure power reliability. The answer—the best and the most economical answer—was in the system shown at the far right, incorporating the full design co-ordination and metal-enclosed safety of modern General Electric substations.

When you consider any substation application, be sure to look into General Electric's *unit approach*. We feel you'll be pleasantly surprised, both by the initial economy and, later, by the on-the-job advantages of increased flexibility and safety. Apparatus Dept., General Electric Company, Schenectady 5, N. Y.

Substation . . .

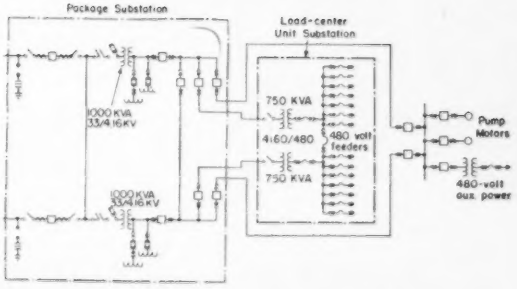


Order large substations as you would a load-center unit—with *one set of 'specs'* and *one order.*

The General Electric *package substation* extends the economical, easy-to-order, easy-to-install features of load-center unit substations to the full range of outdoor substations.

This means you can buy a complete substation *as a unit*—whether it be a 100-kva load-center unit or a complete outdoor substation like that above, with ratings up to 40,000 kva.

You'll find helpful information on all G-E substations in GEA-3592 (Load-center unit substations), GEA-3800 (Master unit substations), and GEA-4500 (Package substations). Get copies from your G-E sales representative, or write to Apparatus Dept., General Electric Company, Schenectady 5, N. Y.



GENERAL ELECTRIC

321-46

The ROCKMASTER "16" Blasting System Cuts The Cost Of Handling Rock!

The story could be summed up in two words: *improved fragmentation*. Or you might prefer *better breakage*. However, the details of the ROCKMASTER "16" story make interesting reading for blasters.

This better breakage has increased loading machine and shovel production as much as 40% in mines, pits, quarries, and construction jobs. Many operators have cut secondary shooting in half . . . others have eliminated it. Time once wasted in uncovering and setting aside big rocks now goes into productive work. There's a sequel to this story! Better breakage means lower costs in milling—less work for the crusher and less wear and tear on equipment.

Better breakage is just one of the many advantages of the new ROCKMASTER "16" Blasting System. It helps you produce more material per pound of explosive . . . gives you more footage per round. Sixteen periods—a wide choice of short or long milli-second delays—add up to better control over throw, backbreak, and material size . . . better control over noise and vibration. Sixteen delay periods fire in 550 milli-seconds! There is less strain on timbers and roof . . . less dust and a quicker return to the face.

From the face and the front office you hear: "ROCKMASTER "16" *is the greatest improvement in blasting methods since Atlas introduced milli-second blasting.*" Write for new booklet showing you how ROCKMASTER "16" fits into your operation.

ROCKMASTER "16" TIMINGS

Rockmaster No.	Avg. Time of Each Delay from Zero (milli-seconds)
0 (zero)	0 (inst.)
1	8
2	25
3	50
4	75
5	100
6	125
7	150
8	175
9	200
10	250
11	300
12	350
13	400
14	450
15	500
16	550

ROCKMASTER: Reg. U. S. Pat. Off.

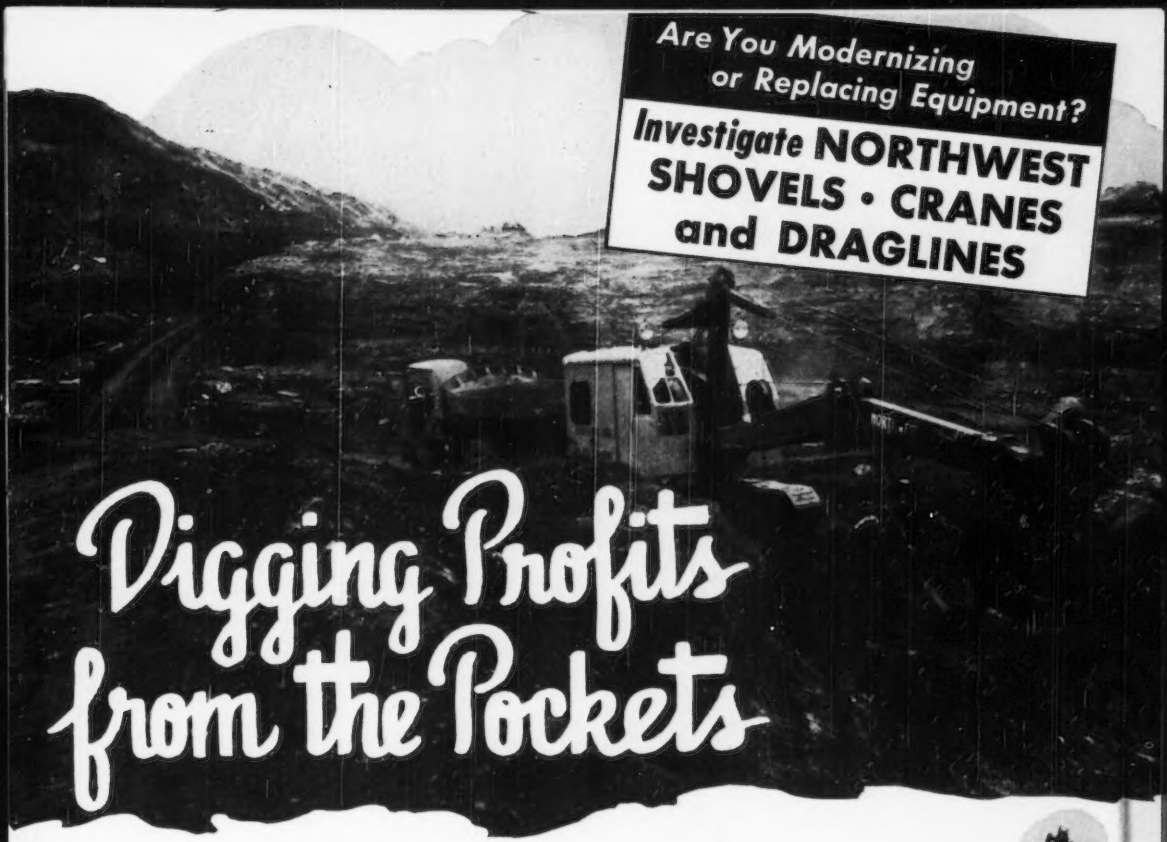
ATLAS EXPLOSIVES *"Everything for Blasting"*

CHEMICALS ATLAS EXPLOSIVES

ATLAS POWDER COMPANY, Wilmington 99, Del. • *Offices in principal cities* • *Cable Address—Atpowco*

Are You Modernizing or Replacing Equipment?

Investigate NORTHWEST SHOVELS • CRANES and DRAGLINES



Digging Profits from the Pockets

HERE'S an unusual mining job — a Northwest Pullshovel being used in the iron ore operations on the Range to clean up rich and profitable pockets. This machine gets around easily on the mine floor, cleans out a pocket quickly and moves on to the next, doing a job the big machines pass over.

Northwests have proved themselves in a wide range of mining work.

The standard Northwest Shovel with its hard rock advantages means higher output in any rock digging. The Northwest Dragline is the solution to many overburden jobs. The Northwest Crane answers the material handling problems around the mill — and, if you need your Northwest truck mounted, there is a combination of Truck Crane and Carrier features found in no other rubber tired equipment.

You are planning equipment modernization and changes. Before buying a Shovel, Crane or Dragline, get details on Northwest equipment and what its advantages will mean to you.

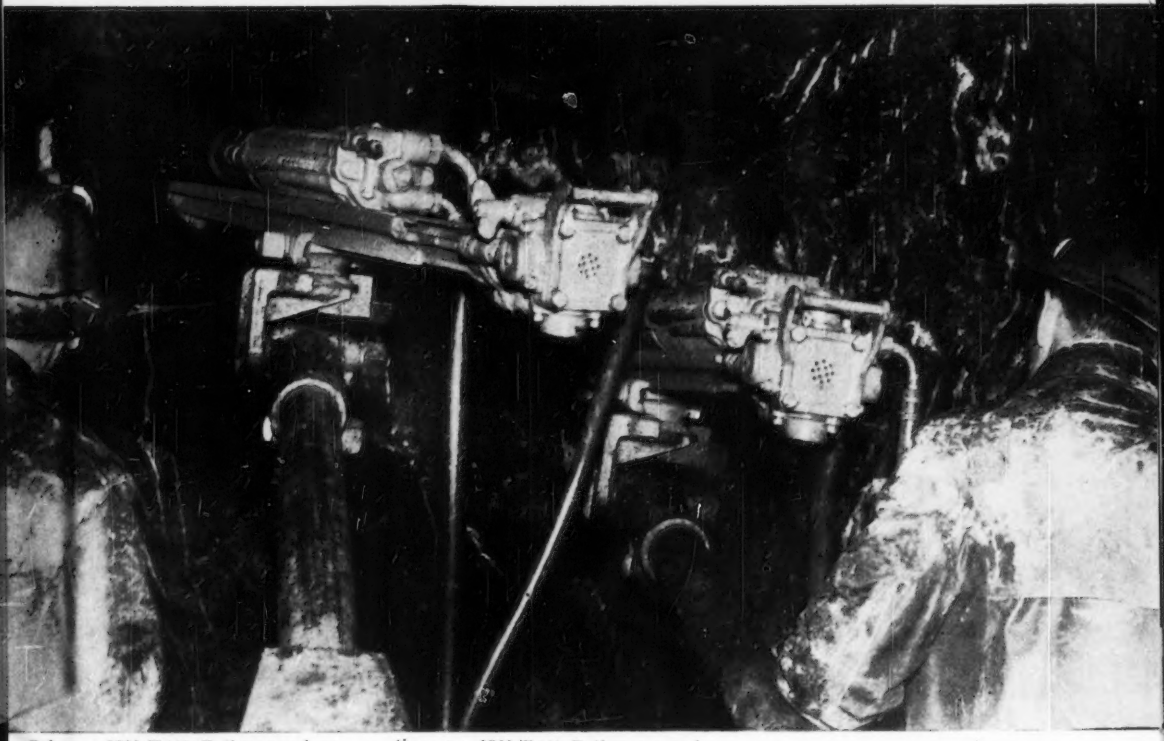
NORTHWEST ENGINEERING COMPANY
1509 Field Building, 135 South LaSalle Street, Chicago 3, Illinois

Northwest Truck Crane unloading crusher parts.

NORTHWEST

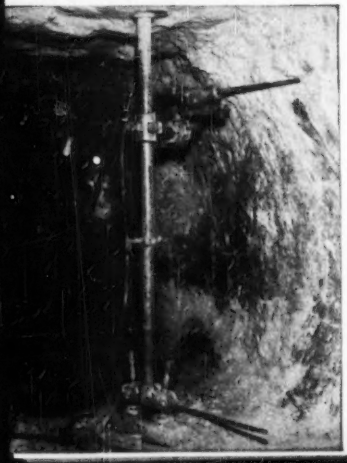
Convertible for any Mining Material Handling or Excavation Problem

Only JOY



Above, two JOY T-350 Drifters mounted on JOY Hydro Drill Jibs.

***Below**, a JOY T-300 Drifter on column mounting in a small heading.*

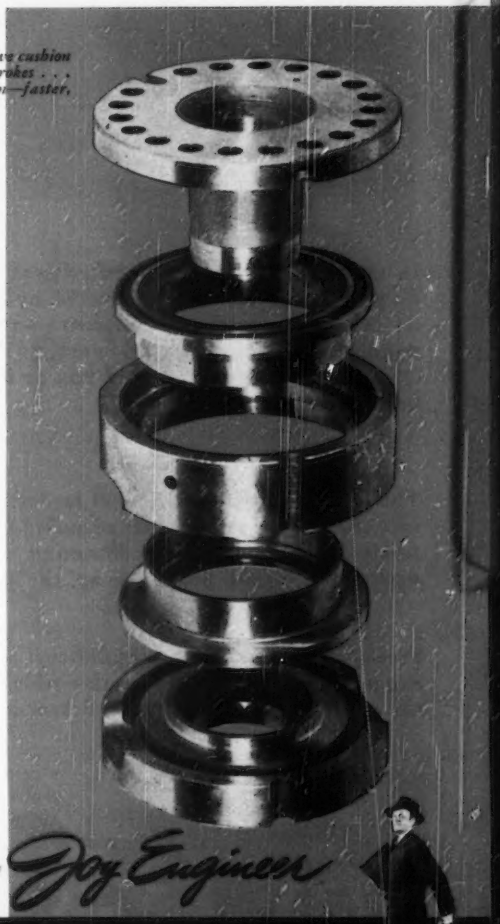


There's a Complete Line of JOY SILVER STREAK STOPERS with DUAL VALVE, CADMIUM PLATING, and the safe THUMB-FLIP rotation control.

Use JOY SULMET BITS—tungsten carbide tipped for longer life, and for more footage with fewer bit changes.

SILVER STREAK ROCK DRILLS

have the DUAL VALVE that makes air do more work!



The JOY Dual Valve gives positive cushion control on both up and down strokes . . . produces powerful piston action—faster, harder punch.

Other exclusive cost-saving features of JOY DRIFTERS:

- CADMIUM PLATING inside and out—inhibits rust, prevents scoring during run-in, increases power by permitting closer piston tolerances, adds to service life of drill.
- PISTONMOTOR FEED—gives smooth, steady advance and safe retraction.
- LOCKING CHUCK with greater bearing area—increases life of chuck parts and drill steel.
- AUTOMATIC DRILL STEEL CENTRALIZER—spots holes safely, easily, accurately.

Write for Bulletins, or *Consult a Joy Engineer*

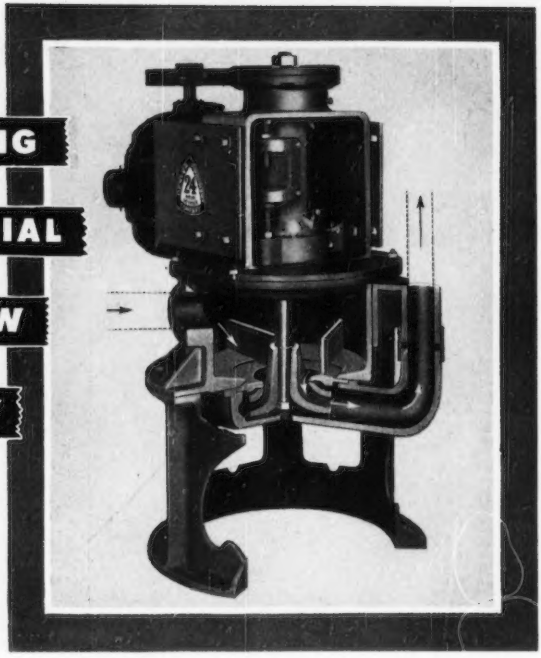
W&D M 2820

JOY MANUFACTURING COMPANY

GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO

FOR PUMPING ANY MINUS ¼" MATERIAL WHICH WILL FLOW BY GRAVITY



2" Denver Vertical Centrifugal Sand Pump. Note that motor and drive are off of floor, above splash and dirt.

Feed to pump flows downward by gravity into pump bowl, thus, there is no danger of feed pipes plugging.

In the Denver Vertical Centrifugal Sand Pump* the feed flows downward by gravity into the pump bowl and down onto the runner. The unrestricted vortex action eliminates the need of a feed box or intake head.

The positive downward flow of feed directly into the runner permits the pumping of difficult-to-handle pulps containing coarse material without plugging up the pump.

Frothy pulps usually present difficult pumping problems because the froth builds up on top of the pulp. The downward flow of feed with the positive suction action eliminates any possibility of air pockets forming in feed pipes.

The Denver Vertical Sand Pump design eliminates the troublesome packing gland. There is no costly maintenance or lost time replacing packing and worn shafts; and, no sealing water, which would dilute pulp, is needed.

The Denver Vertical Sand Pump is made in ¾", 1", 1½", 2", 3" and 4" sizes. The ¾" and 1" sizes are ideal for use in continuous test plants. For further details write any one of the Deco offices listed below.

*Patented and Patents Pending

DENVER EQUIPMENT 24 HOUR SERVICE COMPANY

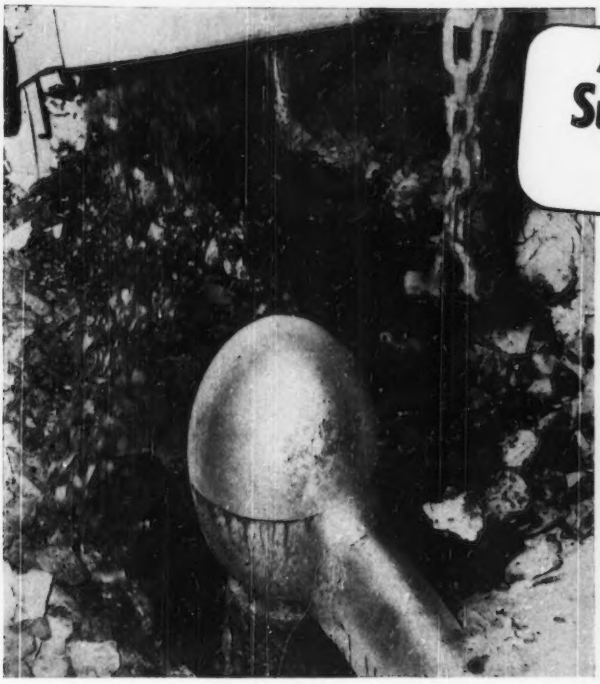
FLOTATION ENGINEERS

Write for Bulletin No. P10-B

"The firm that makes its friends happier, healthier and wealthier"

DENVER • NEW YORK • CHICAGO • EL PASO • VANCOUVER • TORONTO • MEXICO, D.F. • LONDON • JOHANNESBURG • RICHMOND

DENVER EQUIPMENT COMPANY, 1402 17th St., Denver 17, Colorado



ALLIS-CHALMERS
Superior Mc Cully Crushers

Crushing head of old Gates Crusher in use 45 years

Modern Superior McCully Gyratory Crusher

45 Years Crushing Limestone —Over 18 Million Tons!

THAT'S THE RECORD of this 7½ K Gates crusher still going strong 16 hours a day at Southern State Portland Cement Co., Rockmart, Ga.

As a secondary breaker it reduces 100 to 125 TPH of limestone to an approximately 2-inch product.

The Gates crusher was the first of the gyratory type crushers, originated by Allis-Chalmers in 1878. Today Allis-Chalmers offers you the *modern* equivalent — *the Superior McCully crusher line*, in sizes with 8-inch to 60-inch receiving openings.

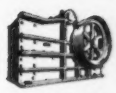
In this crusher the eccentric is located directly below the crushing head, making possible a short rigid shaft which eliminates deflection and decreases bearing wear. Sturdy, massive construction throughout assures long life under heaviest-going demands.

OTHER IMPORTANT FEATURES:

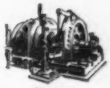
- **Shaft strength is increased 60% over standard long shaft gyratories.**
- **Area of eccentric bearing is 100% larger than in long shaft machines.**
- **Automatic, self-reversing oil pump can be built integral with crusher.**
- **Improved type dust seal excludes dirt from eccentric bearing.**

Send today for new Superior McCully crusher **Bulletin 07B6004B.** Or contact the Allis-Chalmers representative in your area for more facts. A-C offices or distributors are in principal cities in the U.S.A. and throughout the world.

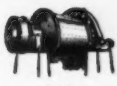
Kilns, Coolers, Dryers



Jaw Crushers



Hoists



Mills

Gyratory Crushers

Vibrating Screens

AND OTHER EQUIPMENT FOR THE CRUSHING, CEMENT AND MINING INDUSTRIES

ALLIS-CHALMERS, 969A SO. 70 ST.
MILWAUKEE, WIS.

ALLIS-CHALMERS

A-2845

FOR

Bigger Output

IN ONE SECOND, Koehring Dumptor dumps full load into feeder. No unproductive waiting for "slow" body hoist to work — gravity dumps load fast and clean in one second.

STEEP GRADES — Ability to pull full loads up grades to 24% make Dumptors especially suitable for heavy hauling out of pits. Sturdy hydraulic brakes give complete control on steep down-hill runs. Parking brake is independent.

ROUGH HAUL ROADS don't slow up Dumptors. Ruts won't twist heavy-duty frame because steering axle oscillates as much as 21", takes the strains out of rough mine road travel. Big tires help cushion shocks, give better traction, flotation.

KOEHRING HEAVY DUTY

in mines, pits and quarries
KOEHRING DUMPTORS
load FASTER • haul FASTER • dump FASTER

ON typical, rough, off-road hauls, you can increase trips per hour, yardage per day and reduce maintenance problems with Koehring heavy-duty, 6-yard Dumptors. Here's why:

Short Turning Radius, Big Target SAVE SPOT AND LOAD TIME

Short, 19'6" turning radius and compact design let Dumptor get close in under shovel . . . save jockeying back and forth. Big, 64 square-foot body opening provides an easy-to-hit target. Result — increased shovel production, more haul-time, less spot and load time.

Heavy-Duty 6-Yard Body BUILT FOR HEAVY ROCK SERVICE

To take severest shocks of shovel-loading, all-welded Dumptor bodies are heavily ribbed with 4" channels. Bottom of seasoned 1-⅜" oak timbers, between two 5/16" steel plates, cushions load shocks. In heavy mine and quarry service, Dumptors give you less down-time, more work-time, year in, year out with less maintenance care.

Ton of Strength per Ton of Payload SPEEDS TRAVEL ON ROUGH HAULS

Koehring Dumptors have rugged 8" ship channel main frame, heavily trussed . . . 4" chrome steel drive axles . . . cast alloy-steel "I" beam steering axle, that take the twists and strains of fast off-road travel. Big rugged tires take road shocks. There are no leaf springs . . . Dumptor needs only one big double-coil spring, on steering axle. You have NO spring maintenance.

6 HP for Every Ton of Gross Weight GIVES GREATER GRADE-ABILITY

Dumptor has 6 HP for every ton of gross vehicle weight. That means more "GO," more acceleration, less shifting on grades. Also, plenty of power to climb grades to 24% with full load. Dumptors are built to stand up under the toughest hauling of mine and quarry service.

No Slow, Troublesome Body Hoists . . . DUMPTOR DUMPS IN ONE SECOND

At the dump, gravity dumps load . . . *fast*. One second and body is empty . . . you're on the way for another load. You save 15 to 25 seconds every dump. No mechanical complications . . . no body hoist maintenance. Free-swinging kick-out pan breaks suction of sticky materials . . . adds 3/16" of steel to strength of Dumptor bottom.

No-Turn Shuttle Operation SAVES SLOW TURNS EVERY TRIP

Because Koehring constant-mesh transmission makes same 3 speeds available in both directions, Dumptors are never turned on shuttle hauls. On a 1,000' haul (16 round trips per hour), this gains 8 minutes every hour.

Let your Koehring distributor show you what Dumptors can do to save money in your mine, pit or quarry.

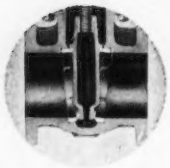
Koehring 605 Rock Shovel Keeps Pace with Fast Dumptor Hauling Speed . . .

For balanced, high-production teamwork on both your excavating and hauling operations, team up your Dumptors with the Koehring heavy-duty 605 Rock Shovel. Its fast operating speeds . . . big 1½-yard dipper capacity . . . rugged, extra strong boom, with shock-absorber mount . . . and big, power-operated clutches, all keep production high, costs low. Your Koehring distributor also can show you heavy-duty Koehring excavators in ½-yard, ¾-yard, 2½-yard sizes to satisfy your exact requirements.

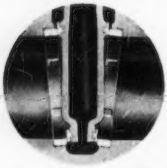
KOEHRING COMPANY, Milwaukee 10, Wisconsin

Subsidiaries: JOHNSON • KWIK-MIX • PARSONS

DUMPTOR—Trademark Reg. U. S. Pat. Off. 1024



Straight-Flow Port Design reduces fluid turbulence to a practical minimum.



Seat Rings of end-seated type are screwed into the body.

Sure-Grip Malleable Handwheel for non-skid gripping even with heavy gloves.

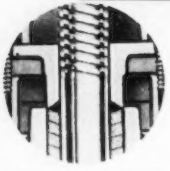
WALWORTH

iron body gate valves

with screwed or flanged ends

... 8 Outstanding Features

For complete information on these new Walworth Iron Body Valves, see your local Walworth distributor, or write for bulletin 106.



Brass Liner on Glands assures greater resistance to corrosion and scoring.

WALWORTH

valves and fittings

60 EAST 42nd STREET NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

T-head Disc-to-Stem connection on OS&Y types provides stronger connection, prevents loosening of disc by corrosion.

Bronze Back-Seat Bushings in bonnets of OS&Y valves.

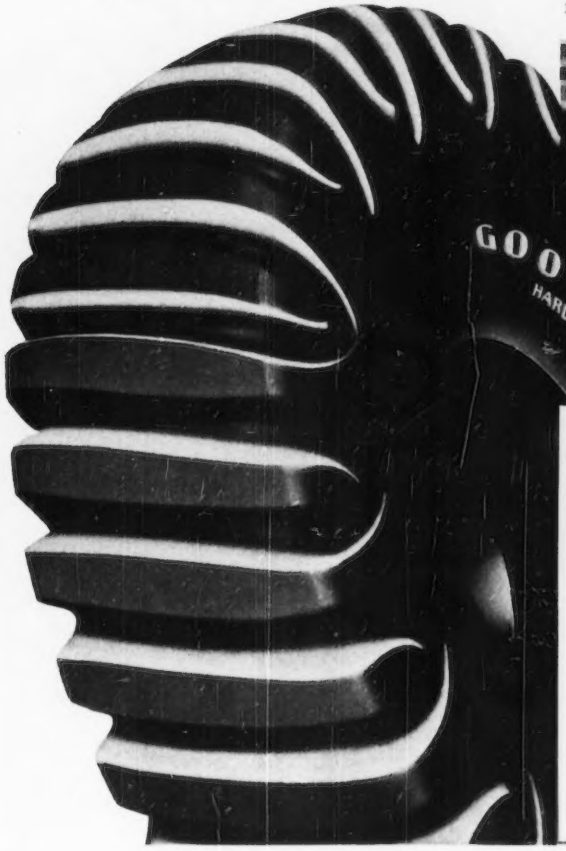
Solid Web Type Disc in OS&Y valves for greater strength and longer service.

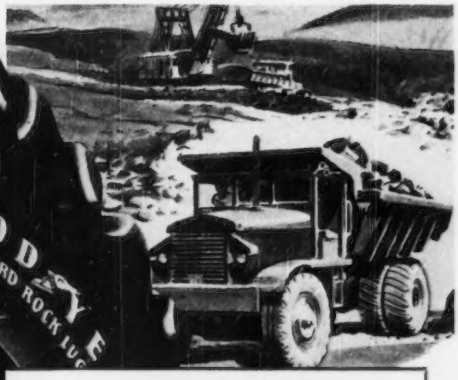
Hinged Gland Eye-Bolts on OS&Y valves permit faster, easier repacking under full pressure.

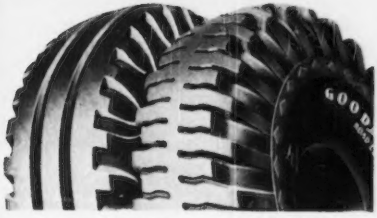
Number 1 tire

for rock work

No tire outperforms Goodyear's famous Hard Rock Lug in tread-tearing back-breaking rock work. Feature for feature, it's your best buy: an extra-tough carcass —extra thick undertread protecting the carcass against bruising—big husky lug bars armoring tread and sidewalls against cuts and rips. And these lugs are designed to form a self-cleaning tread that's tops for traction either forward or reverse. Get the work tire that's head and shoulders above the rest for tire-killing operations. Always BUY and SPECIFY Goodyear—it pays!







THE HARD ROCK RIB

Companion tire for front wheels in rock work – easier steering, smooth rolling, same cord body, same shoulder and sidewall protection as the Hard Rock Lug.

THE ROAD LUG

Specially designed for trucks that operate both OFF- and ON-the-road. This remarkable dual-purpose tire combines off-the-road toughness and traction with on-the-road mileage and economy.

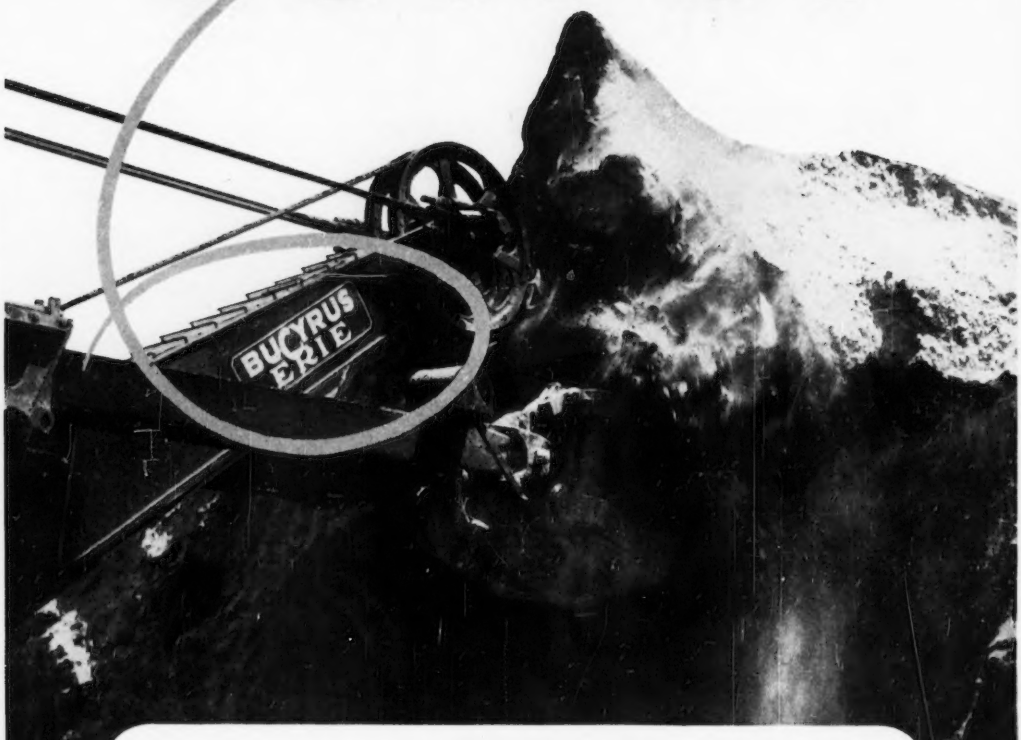
Road Lug—T. M. The Goodyear Tire & Rubber Company

We think you'll like "THE GREATEST STORY EVER TOLD" – Every Sunday – ABC Network

GOODYEAR

MORE TONS ARE HAULED ON GOODYEAR TIRES THAN ON ANY OTHER KIND

The Sign That Means
OUTPUT

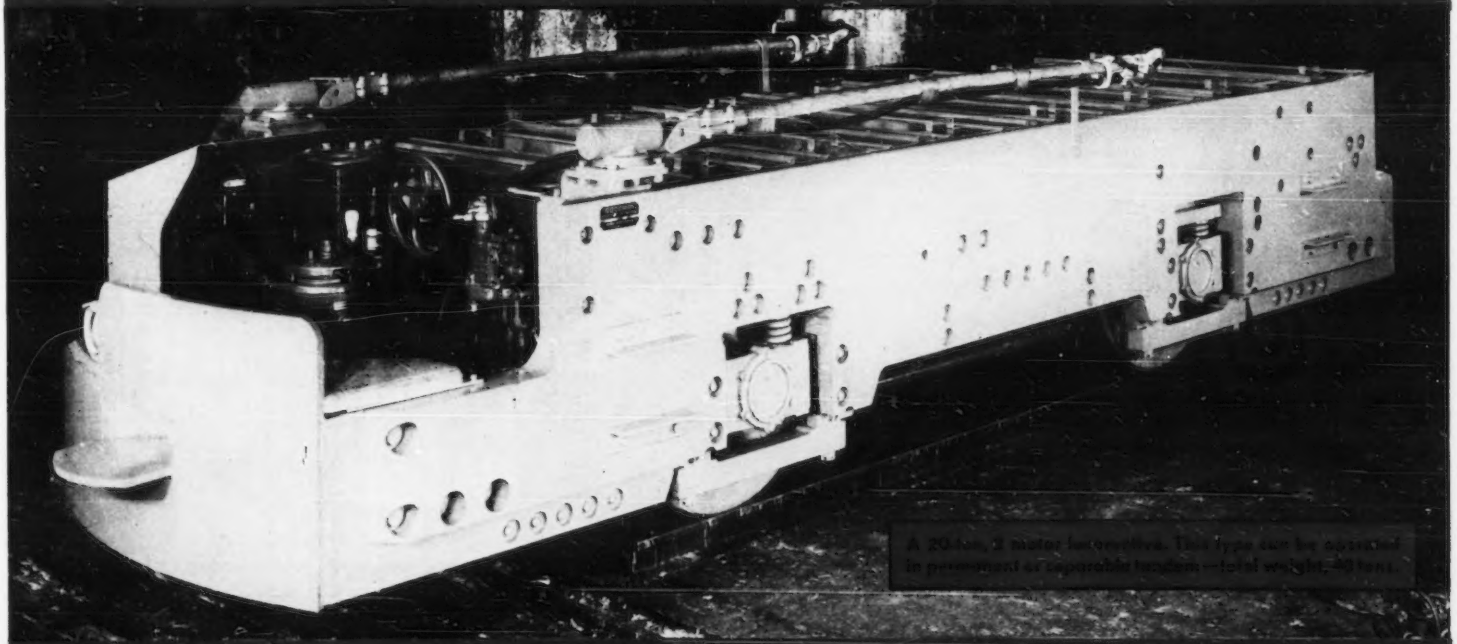


There's good reason why Bucyrus-Erie shovels are preferred in mines and quarries throughout the world, and that reason is — output. For no other excavator quite matches the speed, precision and smoothness of Bucyrus-Erie Ward-Leonard electric control, or the simple, well-balanced *years ahead* design that means faster cycles and greater production every shift. No other excavator quite equals Bucyrus-Eries in ability to stay on the job for dependable service year after year. And no other excavator is built with more careful selection of quality materials, finer craftsmanship or longer practical field experience representing nearly 70 years of continuous leadership in the design and manufacture of excavating machines.

B1L49

BUCYRUS-ERIE COMPANY
SOUTH MILWAUKEE, WISCONSIN

GOODMAN HEAVY HAULAGE EQUIPMENT *for Metal Mines*



A 20-ton, 2 motor locomotive. This type can be operated in permanent or separable tandem—total weight, 40 tons.

HALSTED ST. AT 48TH — GOODMAN MANUFACTURING COMPANY — CHICAGO 9, ILLINOIS

In Great Britain: The Distington Engineering Company, Ltd.

Strong Arm Method Pays Off!

Kaiser Company engineers working hand-in-hand with S-A engineers designed this fast, efficient, heavy-duty ore handling system which supplies the West's only fully integrated steel mill. With the help of the strong movable arm of the stacker-conveyor, stockpiling on a huge scale is made easy.

For nearly half a century S-A engineers have been designing and building bulk materials handling systems to meet specific requirements in almost every field of industry. Equipment dollars work hard, long and profitably when they're spent on S-A designed bulk materials handling systems. Most tons handled at lowest cost per ton is the measure of money-saving ability.

Let S-A engineers give you their recommendations for your bulk materials handling system. There's no charge, of course. Write today.

KAISER COMPANY
EAGLE MOUNTAIN MINE, CAL.

Iron ore, trucked to dump hopper feeds over AMSCO pan feeder and into crusher. Inclined belt then takes ore to second stacker-type belt conveyor mounted with its lower feed end pivoted under head end of the inclined conveyor. Stacker-conveyor is supported, just beyond its center, on traction wheels that run on curved track. This makes an arc of a circle facing storage area, permits stacking more ore over a wider area. AMSCO pan feeder in tunnel under ore pile reclaims ore and feeds to inclined belt conveyor which conveys ore to rail car loading hopper.

STEPHEN S-A DAMSON MFG. CO.

4 Ridgeway Avenue, Aurora, Illinois · Los Angeles, Calif. · Belleville, Ontario

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT

Two Blowers . . . One Purpose:
30 to 100% More Air

Why two totally different blower types? Because the requirements of mine ventilation fall into two entirely different categories.

For high pressures, long pipe lines, use the Coppus VENTAIR (centrifugal type). For medium pressures, shorter pipe lines, the Coppus VANO (propeller type) is best. One or the other will give you more air per given power consumption than other blowers — from 30% to 100% more. Can be used as blowers or exhausters, capacities up to 90,000 CFM, with compressed air or electric motor drive.

Only Coppus makes both types. And, for quick recognition, each wears the famous "Blue Ribbon," distinguishing mark of top-quality engineering, materials and performance. This blue band is your guarantee of better mine ventilation . . . Look for it.

Representatives listed in MINING CATALOGS. Other Coppus "Blue Ribbon" products: steam turbines, gas burners, heat killers, air filters, blowers and exhausters for special purposes. See also THOMAS' REGISTER . . . Coppus Engineering Corporation, 282 Park Ave., Worcester 2, Mass.

COPPUS ENGINEERING CORPORATION
281 Park Avenue, Worcester 2, Mass.

Please send: Bulletin 130.

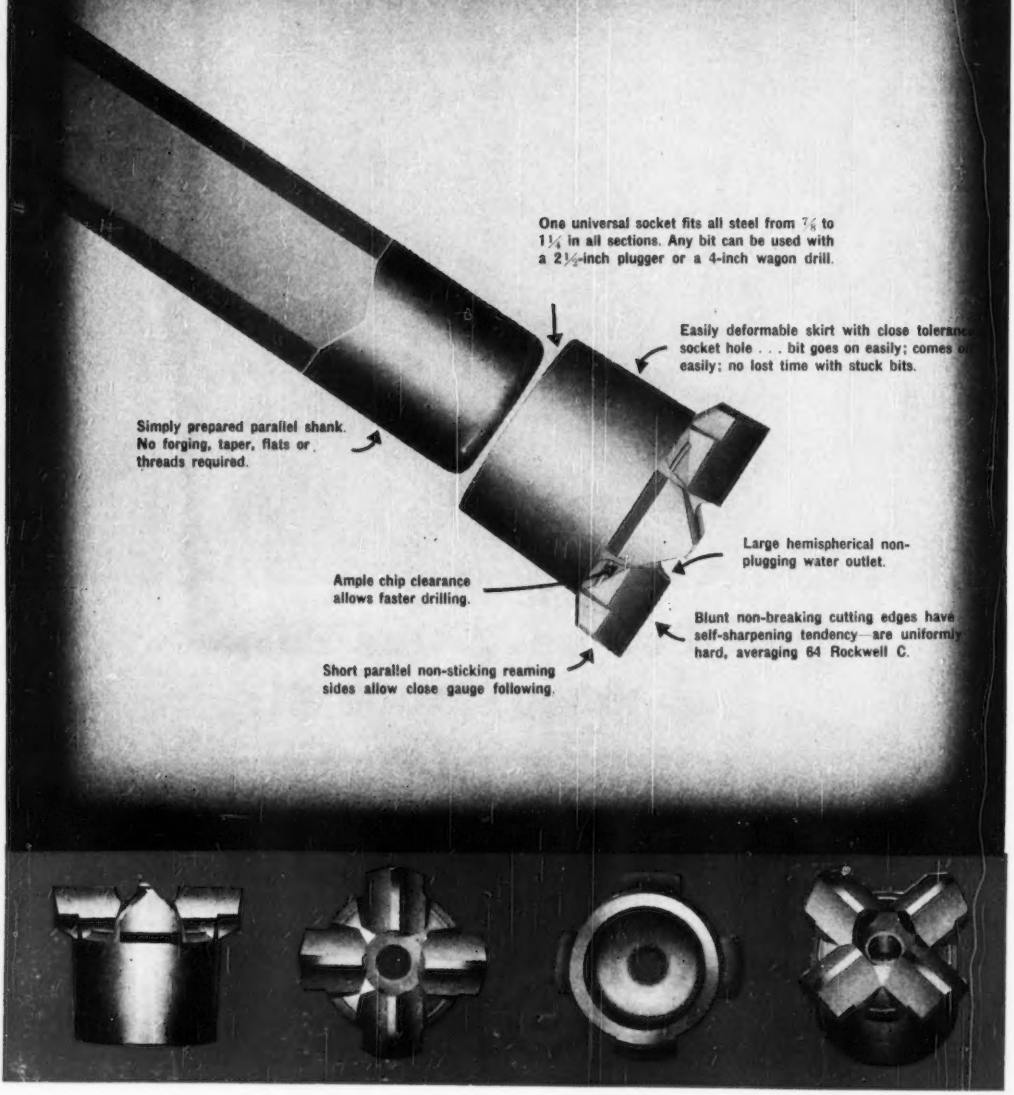
Name.....

Company .....

Address.....

THROWAWAY

DETACHABLE ROCK BITS


One universal socket fits all steel from ¾ to 1¼ in all sections. Any bit can be used with a 2½-inch plugger or a 4-inch wagon drill.
Easily deformable skirt with close tolerance socket hole . . . bit goes on easily; comes off easily; no lost time with stuck bits.
Simply prepared parallel shank. No forging, taper, flats or threads required.
Large hemispherical non-plugging water outlet.
Ample chip clearance allows faster drilling.
Blunt non-breaking cutting edges have self-sharpening tendency—are uniformly hard, averaging 64 Rockwell C.
Short parallel non-sticking reaming sides allow close gauge following.

Case History Number 3

Bunker Hill and Sullivan Mining and Concentrating Company

Kellogg, Idaho

November 30, 1949

Throwaway Bit Corporation
4200 Northwest Yeon Avenue
Portland 10, Oregon

Gentlemen:

In response to your recent request as to the results obtained with Throwaway Bits, the following brief summary will answer your question.

From 1939 to the present time, practically all drilling was done with a nationally known resharpenable type of threaded detachable bit. About eighteen months ago we began to test Throwaway Bits, and the results obtained since that time have been so positive that we are now changing the greater part of our drilling to the Throwaway Bit.

A comparison of the costs is shown below, and in addition, we are getting faster drilling and a considerable saving of powder due to the smaller size of the holes drilled.

Make of Bit	Ft. per Use	Cost per Bit	Cost per Foot of hole drilled
Detachable Bits	2.5	$ .1225 per use	$ .055
Throwaway Bits	12.4	$ .15 per bit	$ .0121

Yours very truly,

R. S. Hooper

R. S. Hooper
Assistant Mine Superintendent

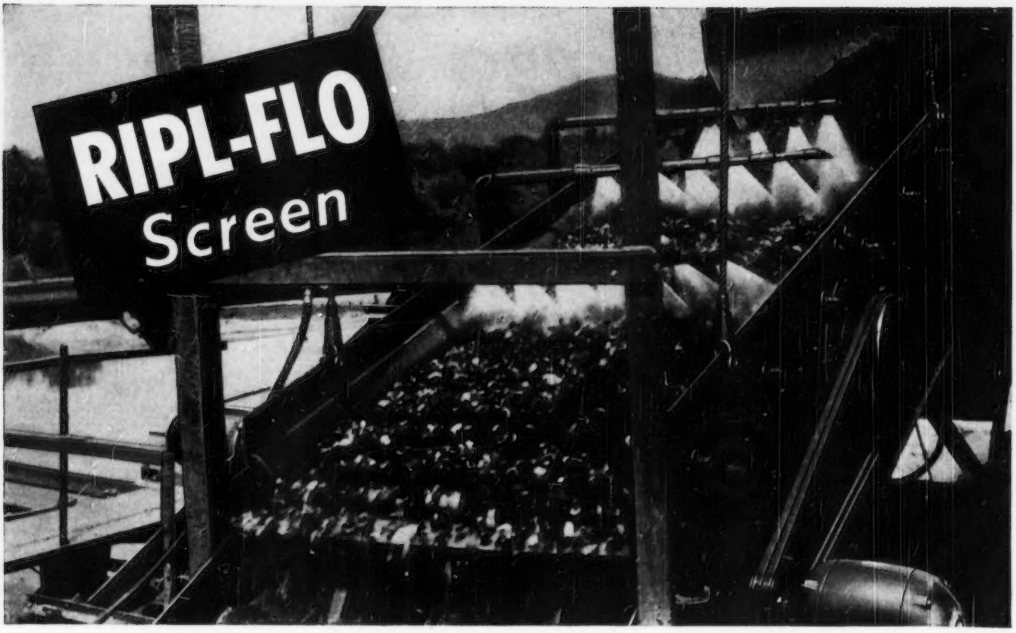
It is the company's policy to avoid grandiose, unsubstantiated claims and to offer results of actual production runs in well known mines, quarries and contracting projects as these become available. Furthermore, the company's metallurgical laboratory, backed by their field men, is constantly endeavoring to give the industry better, faster, further and easier drilling at lower cost per foot with either steel or carbide bits or both.

Fully descriptive literature on all products is available. Competent field engineers and dealers are always at your service.

THROWAWAY BIT CORPORATION

4200 N.W. Yeon Ave. Portland, Oregon, U.S.A.

Throwaway Bits, methods of manufacture, etc., and the name Throwaway are covered by patents already issued, applications for patents, design patents, trademarks, etc. Any infringement will be prosecuted to the full.



"Easiest to Change Cloth ... Has Largest Capacity"

THAT'S THE ENTHUSIASTIC statement of Mr. Gilman Carter, of Twin States Sand & Gravel Co., West Lebanon, N. H., about this 4 x 10 ft double deck *Ripl-Flo* screen.

Used for sizing and washing crushed gravel and sand, this Allis-Chalmers vibrating screen produces 100 TPH of accurately graded products—sometimes feed runs to 150 TPH.

It's loaded to capacity constantly. Yet, after three years' operation, the only repair has been replacing rubber strips for supporting screen surfaces.

Changing or tensioning screen cloth is done quickly, by means of clamping plates conveniently located on outside of screen body — easy to get at.

Ripl-Flo screen's true circular motion to every part of screen surface results in rapid stratification, with no "dead" spots anywhere on cloth area. That's why, size for size, you'll get top screening capacity with this screen.

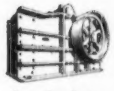
CHECK THESE *RIPL-FLO* FEATURES

- Has only two bearings to lubricate instead of four.
- Offers 17% less width; as much as 36% less weight than comparable screens.
- Adequate support for screen surfaces increases cloth life.
- Simplified design reduces maintenance, power, initial costs.
- Sizes 3x6 to 6x16 ft; 1 to 4 decks.

Get in touch with the Allis-Chalmers representative in your area for more facts about *Ripl-Flo* screens. Or write for **Bulletin 07B6151B.** A-C offices or distributors are in principal cities in the U.S.A. and throughout the world.

Ripl-Flo is an Allis-Chalmers trademark.

Kilns, Coolers, Dryers


Jaw Crushers

Hoists

Mills

Gyratory Crushers

Vibrating Screens

AND OTHER EQUIPMENT FOR THE CRUSHING, CEMENT AND MINING INDUSTRIES

ALLIS-CHALMERS, 969A SO. 70 ST. MILWAUKEE, WIS.

ALLIS-CHALMERS

A2839

unscrambled, they all say one thing...

Low Cost Per Unit of Work

and that means...

Bethlehem Wire Rope

Ever stop to figure the *real* cost of your wire rope—the cost per unit of work? Do you know, for example, what your rope is costing you for every yard of rock it moves? Or every ton of ore, coal, or slate it hoists? Or every ton-mile in oil-country rotary drilling?

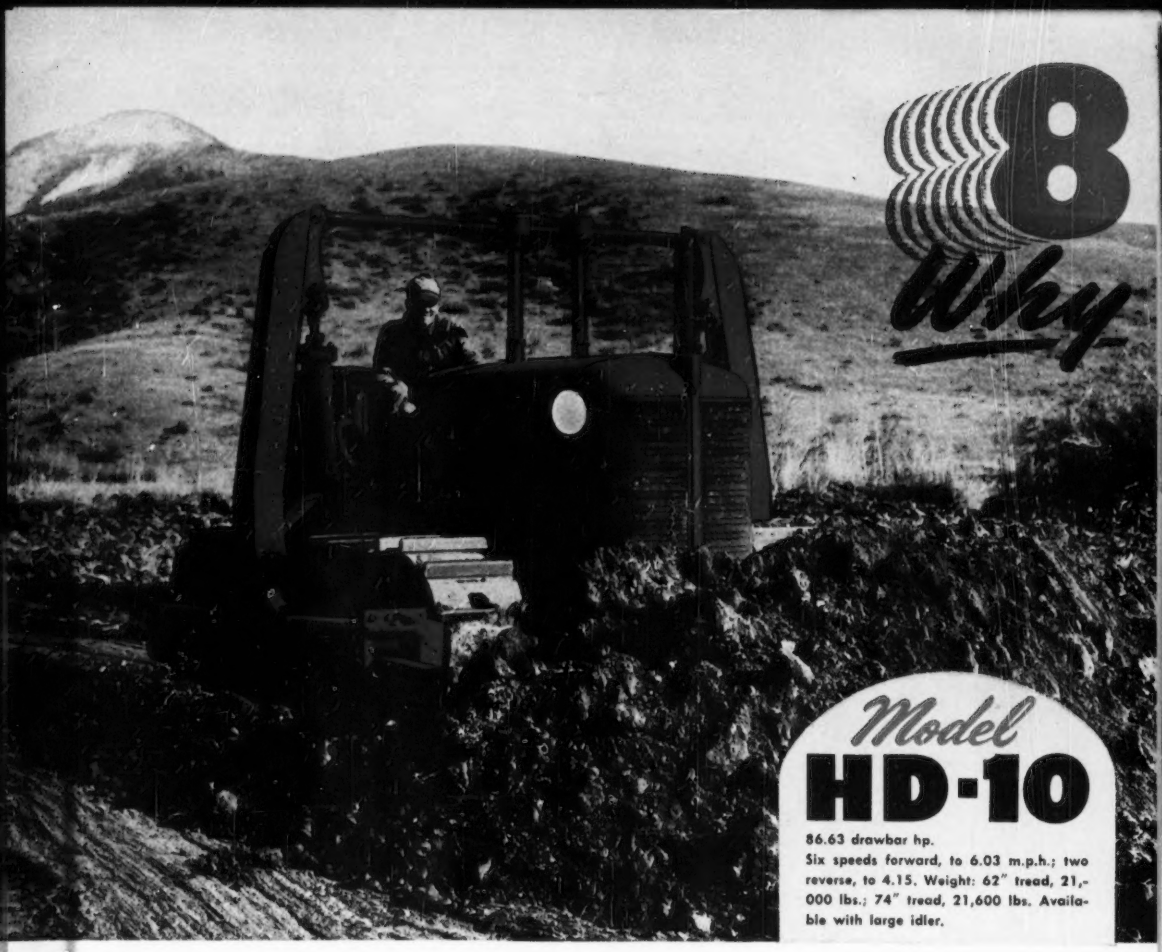
This yardstick—cost per unit of work—is the only *true* measure of wire-rope expense. Purchase price alone is not the answer. The rope with the lowest price tag isn't necessarily a bargain. It's the service life—the total amount of work it will do—that determines your actual cost. That's why we say: specify Bethlehem.

Bethlehem wire rope is a quality product, one carefully and conscientiously built. From the making of the steel to the final reeling and shipping, it is a product that merits your confidence. Because of its long life in service, its cost per unit of work is *low;* it is an economical rope in the truest sense.

Order some today. Check its performance—check thoroughly. We believe you'll soon agree that there isn't a better, more economical rope on the market.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by
Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation


8
Why
Model
HD-10
86.63 drawbar hp.
Six speeds forward, to 6.03 m.p.h.; two reverse, to 4.15. Weight: 62" tread, 21,000 lbs.; 74" tread, 21,600 lbs. Available with large idler.

Let the Outstanding Advantages of These AHEAD-OF-THE-TIME Tractors Boost Your Production and Cut Your Costs...as They Have for Thousands of Owners

1 **1,000-HOUR LUBRICATION** of truck wheels, support rollers and idlers. You operate six months on a 40-hour week basis with just *one lubrication* . . . instead of daily, or even weekly, attention. Think what this means in labor and lubricant savings . . . and in working time gained! Think of the safety factor, too—no costly damage by greasing neglect.

2 **GENERAL MOTORS 2-CYCLE DIESEL ENGINE** Rugged, simple, economical, "hanging-on" power. Smooth — every down stroke a power stroke . . . less wear and tear on tractor and operator. Far less power loss than other engines at high altitudes.

3 **INTERCHANGEABLE ENGINE PARTS** Nearly all of the GM engine wearing parts are interchangeable with each of the GM engines on the various models of A-C tractors and motor graders—no matter the size. Lowers parts investment, simplifies maintenance for Allis-Chalmers fleet owners.

4 **INSTANT STARTING** GM 2-cycle diesel engines start as easily as your automobile . . . and they *start* and *operate* on *diesel fuel*. No need to let 'em idle during work-stop periods — no unnecessary engine wear or fuel waste.

Ask any owner...or arrange for a demonstration with your Allis-Chalmers dealer ..."SEEING IS BELIEVING"

Big Reasons

they're so popular

Model

HD-7

60.10 drawbar hp. Four speeds forward, to 5.00 m.p.h.; reverse to 1.89. Weight: 52" tread, 13,830 lbs.; 63" tread, 14,000 lbs. Available with large idler.

5 **FAST MANEUVERING** 2-cycle diesel tractors are well known for their fast-working ability — not only for quickly traveling from cut to fill, but for turning around instantly in their tracks . . . and for easy maneuvering in and around tight places — especially important on bulldozing. Time saved is money made!

6 **PROPER BALANCE** Weight, speed and power are positively balanced in A-C tractors, assuring top performance on every job — pulling, pushing, lifting.

7 **OPERATOR COMFORT** All these advantages mean operator satisfaction, too — resulting in more work done more easily. Besides — he has a big, wide, comfortable seat, cushioned back, arm rests, roomy platform, convenient controls, good vision.

8 **MATCHED ALLIED EQUIPMENT** Each Allied manufacturer, skilled in his own field, works in complete cooperation with Allis-Chalmers in designing and building auxiliary equipment.

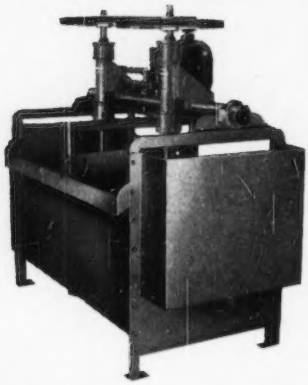
ALLIS-CHALMERS

TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

Originator of the Torque Converter Tractor

FOR BETTER ORE RECOVERY METHODS

AGITAIR
FLOTATION MACHINE



focus on these facts

STURDY CONSTRUCTION — all steel fabrication with protective rubber coatings in the wear zone provides Agitair with all the rugged qualifications required for successful service in the ore concentrating industry.

REVOLUTIONARY DESIGN — the simplicity of Agitair's operation is unequalled. Complete control of the ratio of air, pulp and froth is available to the operator at all times.

RECORD OF PERFORMANCE — years of on-the-job service have proven the efficiency of Agitair. A typical mill report indicates power savings of 46% and recoveries that exceed test results by more than 1%.

WORLD-WIDE ACCEPTANCE — is Agitair's claim to leadership in the art of flotation recovery.

Write for detailed information on how Agitair's economical and efficient operation can be applied to your specific problem.

"Leaders in Experience and Service"

THE GALIGHER COMPANY

METALLURGICAL DIVISION

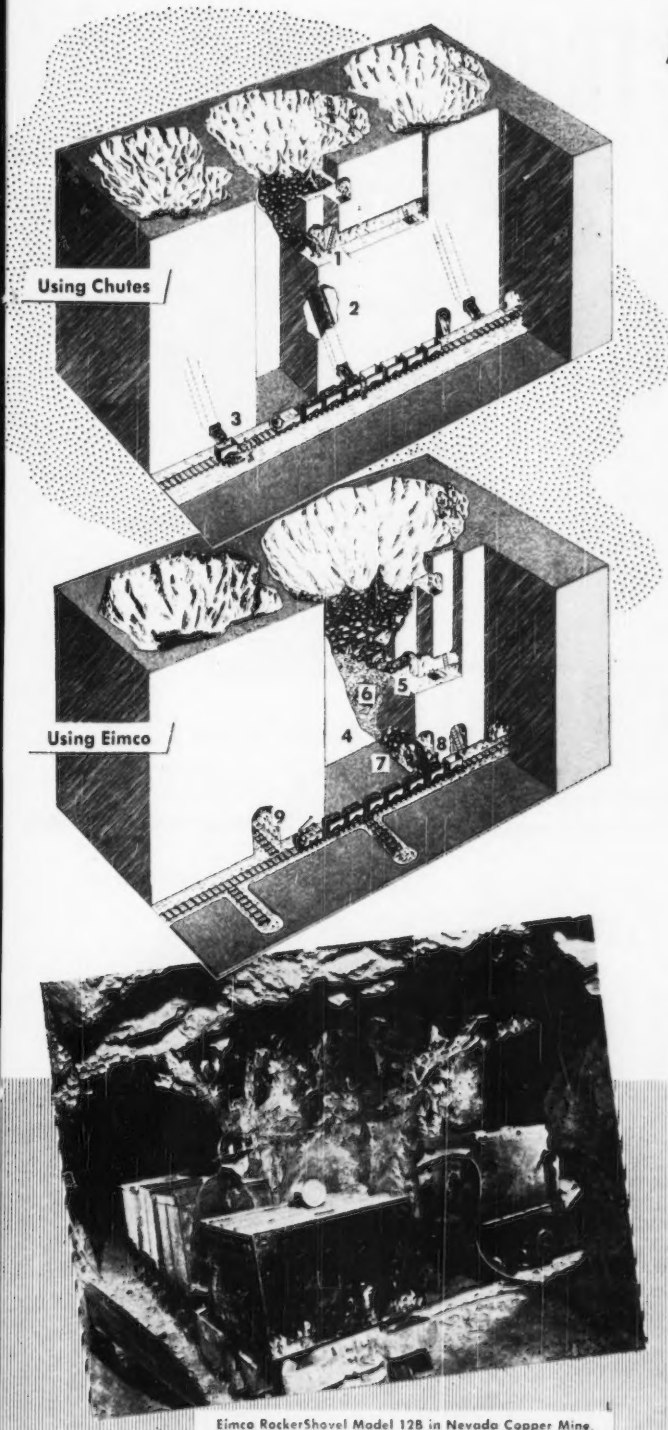
CONSULTATION • ORE TESTING • PLANT DESIGN • CONSTRUCTION

HOME OFFICE
[illegible] WEST 200 SOUTH
SALT LAKE CITY, UTAH
P.O. BOX 569

EASTERN OFFICE
921 BERGEN AVENUE
JERSEY CITY
NEW JERSEY

AGENTS IN ALL PRINCIPAL FOREIGN MINING DISTRICTS

Mechanical Loading From Draw-Holes



Eimco RockerShovel Model 12B in Nevada Copper Mine.
Loading from shrinkage stope draw-point.

Eimco RockerShovels are used by many companies for loading ore from draw points in their mines. Several companies have converted one area to mechanical loading and have retained chutes, gates and grizzlies in another area to obtain for themselves first hand cost figures under their particular conditions. In every case, the mines using Eimco RockerShovels show the following advantages for mechanical loading:

1. Less labor overall required. (The customary stope grizzly man is eliminated, and loader operator takes the place of a chute tapper.)
2. The initial stope development cost is less.
3. Upkeep of drawpoint is only a fraction of the upkeep cost of timbered chutes.
4. Undercutting stope can be started at a lower elevation thus increasing recovery.
5. Accident hazards reduced with elimination of grizzly work and chute pulling.
6. Drawpoint offers better facilities for ore storage. Ores tending to pack and hangup can be blasted loose without damage.
7. Larger muck can be handled with resultant savings in initial breaking and secondary blasting costs.
8. Secondary blasting can be done at end of shift.
9. Eliminates use of powder in haulage way and its attendant effects on efficiency and ventilation.

Write for Bulletin L-1017 on Mechanical Loading from Drawpoints showing many systems in detail.

EIMCO

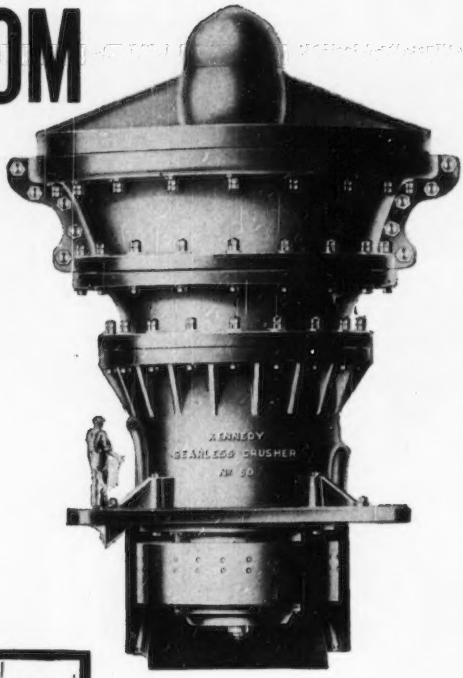
THE EIMCO CORPORATION

The World's Largest Manufacturers of Underground Rock Loading Machines

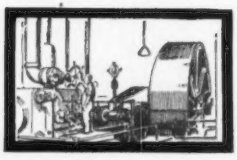
EXECUTIVE OFFICES AND FACTORIES — SALT LAKE CITY 8, UTAH, U. S. A.
BRANCHES: NEW YORK, CHICAGO, BIRMINGHAM, EL PASO, BERKELEY, DULUTH
AFFILIATED COMPANIES: SOCIETE EIMCO, PARIS, FRANCE
EIMCO (GREAT BRITAIN) LTD., LEEDS 12, ENGLAND
AGENTS IN ALL PRINCIPAL CITIES THROUGHOUT THE WORLD

A 585

YOU'RE SAFE FROM POWER SHORTAGE

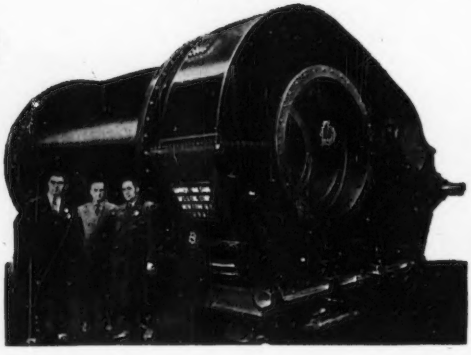


It's BAD to run short on POWER when you run a big CRUSHER. You DON'T DO THAT, ever, when you use a "KVS" Gearless. KINETIC ENERGY is exactly what gives you ADDED FREE POWER in the "KVS" Gearless Crusher for no added cost. That's the extra power that results when a big pulley or flywheel whirls around—like the big pulley on the old Corliss Engine. A BIG Pulley in the "KVS" Gearless! It whirls around at a speed of 3,500 ft. per minute —and what EXTRA crushing energy or crushing power you get! What's more, the 8-ton pulley (used in a "KVS" Crusher weighing 400,000 lbs.) whirls so easily you can turn it with TWO FINGERS! In short, more CRUSHING for LESS POWER COST, is the idea that puts "KVS" way out in front, and keeps it there!



• *Send for the* **NEW "KVS" BULLETIN**

—and you're safe from money waste



How'd you like to save about $6,000 on a 10 ft. tube or ball mill? Well, suppose you decide on a "KVS" with integral gear drive. The Kennedy INTEGRAL GEAR DRIVE enables motor to be DIRECT CONNECTED to driving shaft. Shaft is carried in roller bearings that CANNOT be misaligned or set wrong. The pinion shaft to which the motor is connected runs at approximately 600 r.p.m. while other pinion shafts run at about 180 r.p.m. ON A 10 FT. MILL THIS ENABLES YOU TO PURCHASE THE SYNCHRONOUS MOTOR AT A SAVING OF ABOUT $6,000. What's more, "KVS" trunnions on large sized tube and ball mills are CARRIED ON OIL. The bearing never wears out, uses little power. All gears and bearings are automatically sprayed with oil before tube mill is started (Design patented). Believe it or not, in 15 years no "KVS" gears or pinions have worn out on this type mill.

"THE PRODUCTS WITH THE TROUBLES LEFT OUT...

YOU'RE SAFE FROM DOUBT

when you read these figures:

SPEAKING OF CRUSHING . . . .

LOCATION: NATIONALLY KNOWN MINING CO. IN NEW YORK STATE

CRUSHERS: FOUR NO. 37½ KENNEDY TYPE "S" ROLLER BEARING GYRATORY CRUSHERS

FEED OPENING: 6¼"; **DIAMETER OF HEAD:** 3 FEET

DISCHARGE SETTING: 7/32" CLOSED SIDE AT HEAD

CAPACITY EACH CRUSHER: 56 TONS PER HOUR

HORSEPOWER EACH CRUSHER: 48 HP.

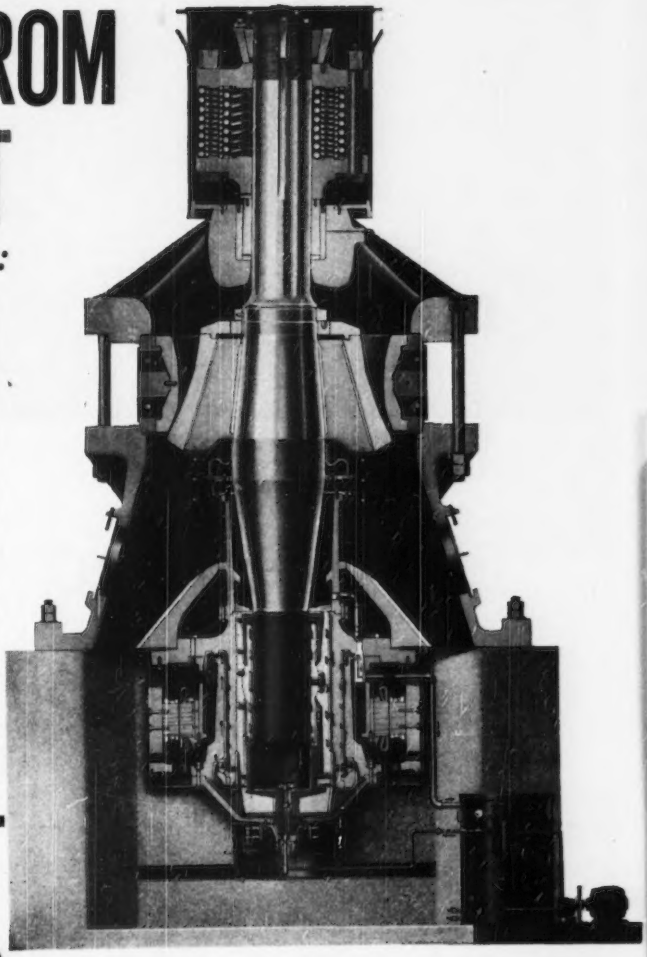
CLOSED CIRCUIT OPERATION

GRADATION AS FOLLOWS:

THE FIGURES!

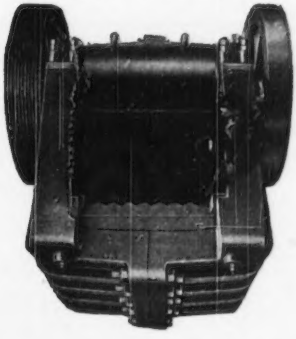
99.8%	Minus	3	MESH
93.3	"	4	"
80.6	"	6	"
66.6	"	8	"
56.1	"	10	"
48.1	"	14	"
40.6	"	20	"

Can You Equal These Figures?



—and safe from waste *energy . . . .*

ENERGY expended to keep a swing jaw crushing is WASTED if ALL the load goes on ONE jaw! So, in the "KVS", both swing jaw and stationary jaw are set at the same inclination. Stationary jaw carries fully 50 percent of load . . . result, you need LESS POWER to keep the swing jaw swinging and crushing. Note another thing—the swing jaw is all ONE PIECE, except renewable crushing plate. Also swing and stationary jaws are interchangeable, both the same length, and reversible end-for-end, giving twice as much crushing life before renewal is needed.

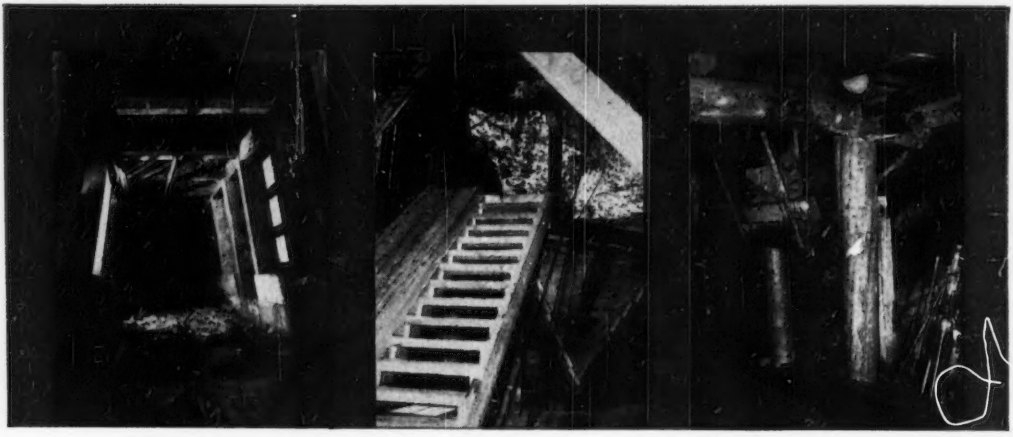


Kennedy-Van Saun

MANUFACTURING AND ENGINEERING CORPORATION

2 PARK AVE., NEW YORK 16, N. Y.

FACTORIES:
DANVILLE, PA., U.S.A.
CANADA, ENGLAND, FRANCE, AUSTRALIA



for **TIES** and **TIMBERS** that last longer!

Use penta-chlorophenol treated wood!

The outstanding advantages of "PENTA"-protected wood are these:

PENTA-treated wood is protected from decay and termites, its service life extended far beyond that of untreated wood.

"PENTA" enables you to capitalize on wood's versatility, easy workability, and economy.

"PENTA" leaves wood clean and easy to handle. The increased durability of "PENTA"-treated wood adds materially to its salvage value. For more information about PENTAchlorophenol write Dow, Dept. PE 12.

DOW
penta-
chlorophenol

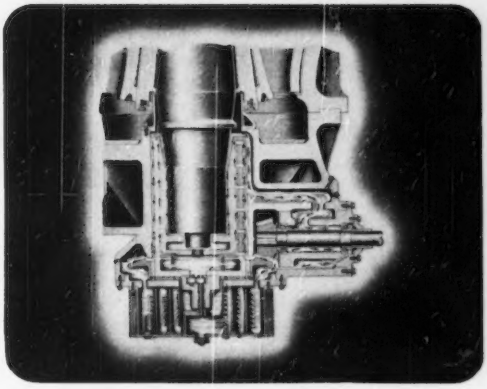
THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

First Choice

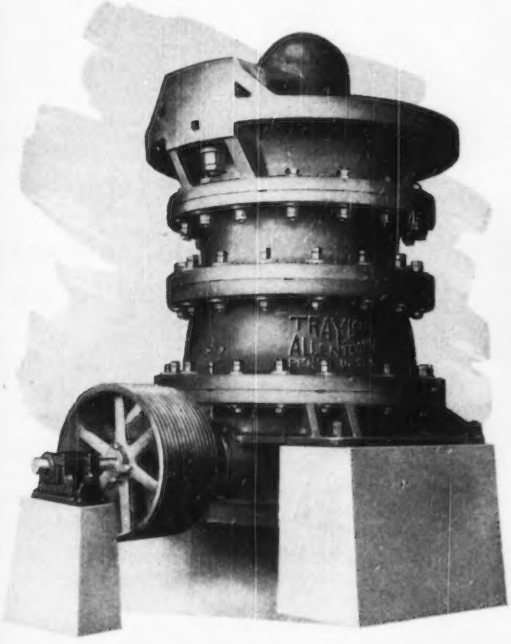
when Huge Tonnage is a Primary Problem

Many plants of less than 10,000 tons daily capacity, and *all larger plants*, will operate with greater efficiency using a Traylor Gyratory Crusher for primary breaking. That's because of its very large capacity in relation to power required.

But, tremendous capacity is not the only advantage of the Traylor Gyratory Crusher. The receiving openings of all models are ample. This teams them efficiently with all large capacity material handling equipment. Operated at, or near, capacity, the power they use is extremely low per ton. Simple design and superb construction reduce maintenance . . assure long, trouble-free operation.



Among the features of these fine crushers is a positive, automatic, pressure-feed lubrication system. Every moment of operation the full length of the eccentric bearing and the main pinion are bathed in cooled oil from a generous reservoir kept dust-free with Traylor's exclusive, effective dust seal.



Bulletin 4100 contains a complete description and pictures of the Traylor Gyratory Crusher as well as basic tables and information to help you make your selection of a crusher on the basis of best operating practice. Write for your copy today.

Traylor

Rotary Kilns, Coolers and Dryers
Grinding Mills . . Crushing Rolls
Jaw, Reduction and Gyratory Crushers

TRAYLOR ENGINEERING & MANUFACTURING CO.
108 Mill St., Allentown, Pa.

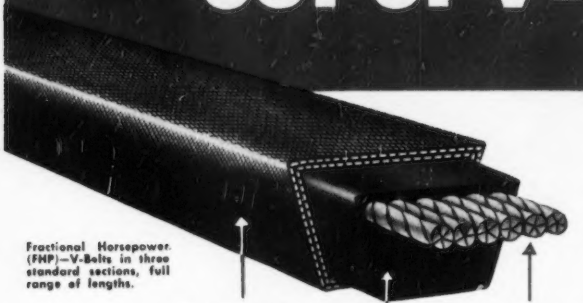
Sales Offices: New York, N. Y., Chicago, Ill., Los Angeles, Calif.
Canadian Mfrs: Canadian Vickers, Ltd., Montreal, P. Q.

A "TRAYLOR" LEADS TO GREATER PROFITS

BWH

DEPENDABLE RUGGEDNESS

BULL DOG V-BELTS demonstrate how to get the most out of V-Belts



Fractional Horsepower (FHP)—V-Belts in three standard sections, full range of lengths.

WEAR-RESISTANT COVER, protects heart of belt from dirt, grease, moisture.

COMPRESSION SECTION, engineered to withstand continual flexing.

BULL DOG CORDS, powerful load-carrying section.

Industrial V-Belts in A, B, C, D and E sections — full range of lengths from 26"-660".

OUTSTANDING ADVANTAGES OF BULL DOG V-BELTS

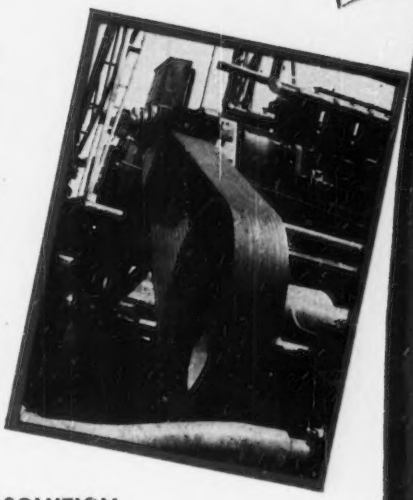
1. **Fewer Maintenance Headaches.** Because BULL DOG V-BELTS require less adjusting and last longer, they save time, money and worry in maintenance.

2. **Longer Belt Life.** Because new, quality-controlled compounds developed in BWH laboratories run cool, don't crack or deteriorate under severe flexing.

3. **Backed by BWH Reputation for Extra Service.** In the 72 years that BWH has been a leader in the mechanical rubber manufacturing field, BWH products have built steady fame for outstanding performance. BULL-DOG V-BELTS fully live up to BWH reputation for dependable ruggedness.

Efficient V-Belt operation insures steady, smooth, low-cost power transmission, without maintenance worries, over long periods of time. And that's exactly the kind of economical, worry-free service BULL DOG V-BELTS deliver in all types of industry.

Each job has its own problems, however. Here are some of the common ones that engineers report in V-Belt operation, with BWH solutions:



PROBLEM	SOLUTION
Excessive Cover Wear on V-Belts	Check sheaves for worn grooves. Check alignment between sheaves. Check to see that sheaves are tight on shafts.
Covers Loosen .. Rubber Gets Soft and Sticky	Check for excessive oily conditions. If contact with oil or grease cannot be prevented, then specify BULL DOG HSO V-BELTS, which are oil resistant. (Also heat resistant and static conducting.)
V-Belts Failing Within Few Hours of Installation	This is usually caused by prying V-Belts over edge of sheaves, causing internal cords to break. Correct method of installation is to move motor of driven machine until belts do not have to be forced onto sheaves. Then move motor back until sufficient tension is applied.
New V-Belt Installed As Replacement Fails, While Old Belts Continue Running	Never install a new belt in a set of old belts, because it will be either shorter or longer than the old belts. If shorter, it will be excessively overloaded and fail. If longer, it will not transmit an equal share of the load. Always install a complete new set of belts and retain old belts for an emergency, or for temporary replacement if needed.

It will pay you to investigate BULL DOG V-BELTS on your next installation. They have what it takes for smoother operation on both FHP motors and on high-powered industrial jobs.

HAVE YOU A JOB WHERE STAMINA COUNTS?

Bring us your toughest problems. We're specialists in solving them. Consult your nearest BWH distributor or write us direct.

FOR ALL MECHANICAL RUBBER GOODS CONSULT BWH

Established in 1878, BWH is today one of the world's largest manufacturers of mechanical rubber goods. Among the quality-famous BWH products which are today helping industry to do better jobs at lower cost are the following:

CONVEYOR BELTING	OIL INDUSTRY HOSE
ELEVATOR BELTING	STEAM HOSE
TRANSMISSION BELTING	WATER HOSE
AIR HOSE	OIL FIELD SUPPLIES
CONTRACTORS' HOSE	FRICTION TAPE
FIRE HOSE	SPLICING COMPOUND

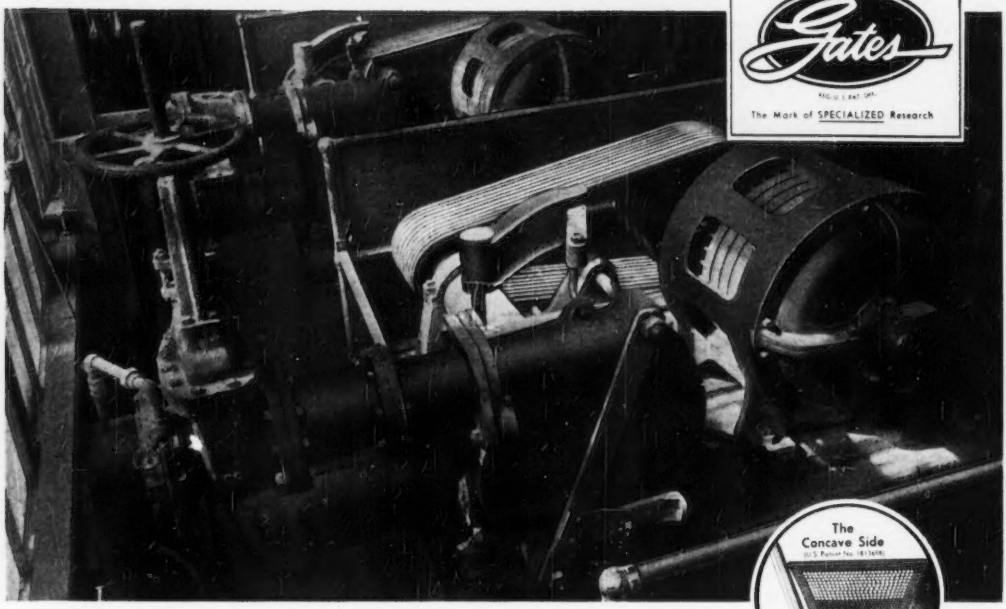
BWH
DEPENDABLE RUGGEDNESS

Another Quality Product of

BOSTON WOVEN HOSE & RUBBER COMPANY

Distributors in all Principal Cities

PLANT: CAMBRIDGE, MASS., U.S.A. • P.O. BOX 1071, BOSTON 3, MASS., U.S.A.



These big sand pumps handle thickened slimes at the outlet of Miami Copper's 8,000,000 gallon thickener. Operators like the Gates Vulco Rope Drives because if anything happens to a pump and the drives get wet these V-Belts, which run in grooved sheaves, do not slip off. Also, a simple change in sheave size easily provides a considerable change in pump speeds.

Two Distinct *Savings* in *V-Belt Costs* Are Yours with Gates Vulco Ropes

A simple test that takes less than two minutes will save you many dollars in V-Belt costs. Here it is—

Have someone bend a V-Belt exactly as it bends in going around its pulley. As it bends, grip its sides with your fingers. You will *feel* those sides *change shape.* In a straight-sided V-Belt, the sides become *convex* as the belt bends. And note how the sides *bulge out.* (Figures 1 and 1A)

Now try the same test with a V-Belt that is built with the concave side. You will feel a change in shape—but a *different result!* The sides do not become *convex.* Instead, they become perfectly straight. *The bent belt now has a shape that exactly fits its sheave groove*—as shown in Figures 2 and 2A.

Two distinct savings result. *First*—There is no side-bulge to cause uneven wear. The sides press *evenly* against the V pulley and therefore wear *uniformly*—resulting in *longer life!* Second—The *full width* of the sidewall grips the pulley—thus carrying heavier loads without slippage—and this *saves belts* and also saves *power!*

When you buy V-Belts, be sure you get the V-Belt with the Concave Sides... the Gates Vulco Rope!

What Happens When a V-Belt Bends

Straight-Sided V-Belt

How Straight-Sided V-Belt Bulges in Sheave-Groove.

Gates Vulco Rope with Concave Side.

No Side Bulge. Precise Fit in Sheave Groove.

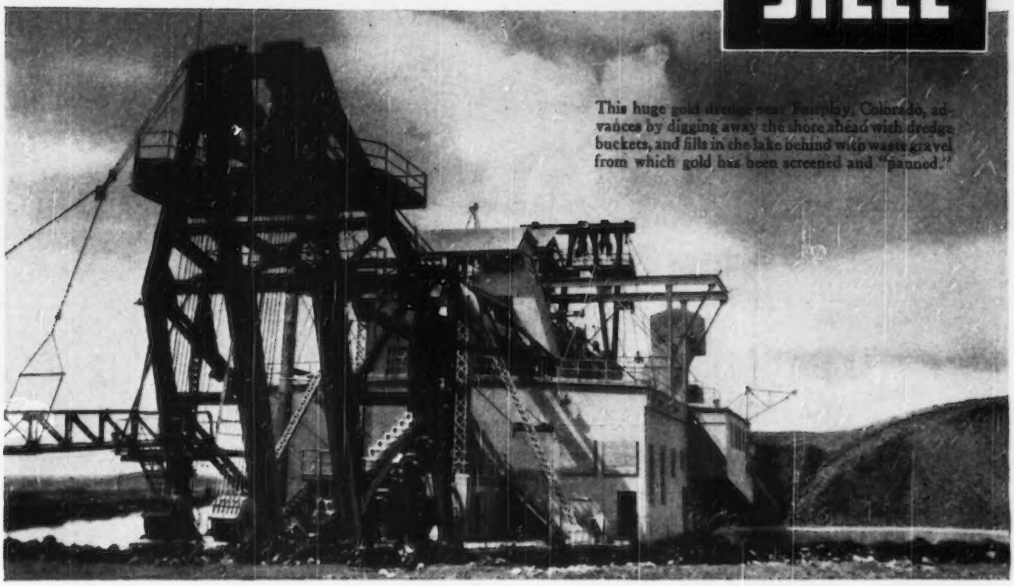
C S 501

THE GATES RUBBER COMPANY
DENVER, U.S.A.
The World's Largest Makers of V-Belts

GATES VULCO ROPE DRIVES
Engineering Offices and Jobber Stocks IN ALL INDUSTRIAL CENTERS of the U.S. and 71 Foreign Countries

4 miles of J&L WIRE ROPE
is used to operate
MILLION-DOLLAR Gold Dredge

J&L STEEL



This huge gold dredge near Fairplay, Colorado, advances by digging away the shore ahead with dredge buckets, and fills in the lake behind with waste gravel from which gold has been screened and "panned."

South Platte Dredging Company gets longer life and greater economy from J&L Wire Rope

More than 4 miles of J&L wire rope is used to operate the $1,000,000 gold dredging boat, illustrated above.

Wire rope raises and lowers the "ladder" of dredge buckets. Others operate the "stackers" that dispose of waste gravel. The boat moves forward by wire rope, and is rotated by wire rope.

Wire rope operates the 45-ton "spud" or anchor on which the boat pivots. This spud, driven into the bottom of the 70-foot lake, supports the boat while dredging. Still more wire rope is used for auxiliary winches.

South Platte Dredging Co., operator of this "Goliath", near Fairplay, Colorado, reports that by comparison, J&L Wire Rope is more dependable, gives longer service life and is more economical.

During winter operations sections of frozen bank, when undercut, drop onto the "ladder" causing sudden strains on the wire ropes . . . or falling into the lake, rock the boat and put extra strain on bow lines and guys.

Operating conditions are made still worse because the wire rope must *operate with no external lubrication*. Any grease or lubricant in the water would lessen the recovery of gold.

J&L wire rope lasts longer under such conditions, because it is *Precisionbilt* with quality-controlled steel. Wires, drawn with uniform precision, are fitted together accurately to provide the longest possible wear.

Our new handbook, "Wire Rope Is a Machine", tells how to operate and maintain wire rope for maximum service. It is written *for the man on the job.* If you use wire rope, you'll want a copy. Return the coupon today!

Jones & Laughlin Steel Corporation
412 Jones & Laughlin Building
Pittsburgh 19, Pa.

Please send me a free copy of your new handbook, "Wire Rope Is a Machine."

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Company_____

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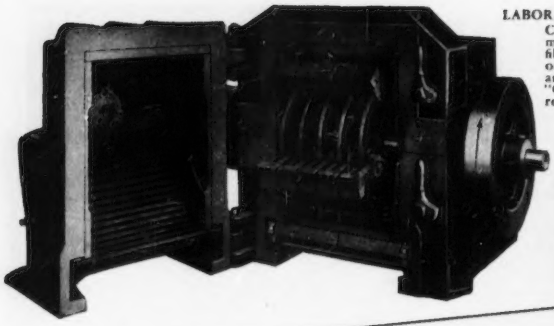
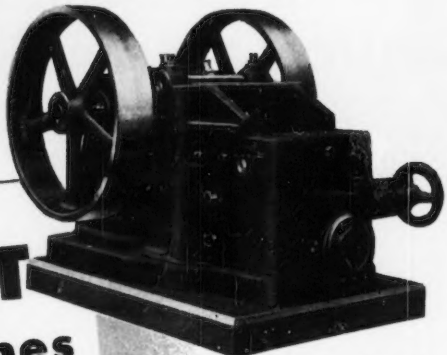
From its own raw materials, J&L *manufactures a full line of carbon steel products, as well as certain products in* OTISCOLOY *and* JALLOY *(hi-tensile steels).*

PRINCIPAL PRODUCTS: HOT ROLLED AND COLD FINISHED BARS AND SHAPES • STRUCTURAL SHAPES • HOT AND COLD ROLLED STRIP AND SHEETS • TUBULAR, WIRE AND TIN MILL PRODUCTS • "PRECISIONBILT" WIRE ROPE • COAL CHEMICALS



LABORATORY SWING-SLEDGE MILLS

Capable of reducing soft, moderately hard and tough or fibrous materials to any degree of fineness between 1 in. and 20 mesh. The patented "Open-Door" feature permits ready accessibility for cleaning.



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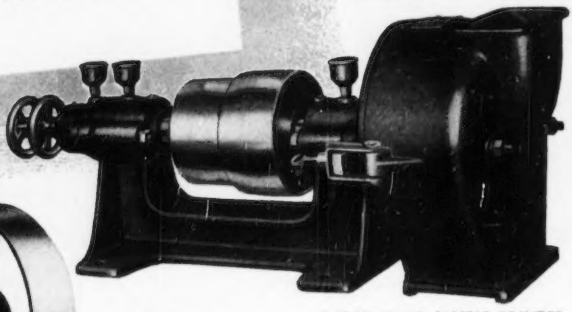
Laboratory Machines

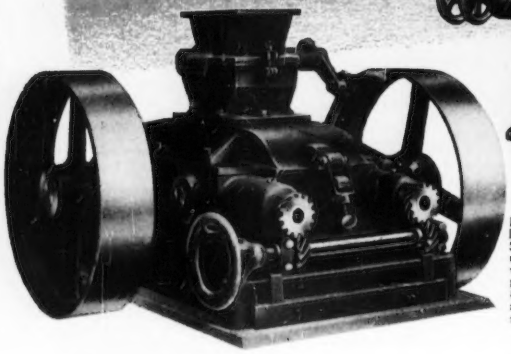
Assure Quality of Products

Fast - Economical - Accurate

LABORATORY JAW CRUSHERS

Special Roll Jaw action simplifies close regulation of the product with capacities varying from 300 or 400 lbs. per hour at finest settings, to 1000 or 2000 lbs. when opened for coarser work. Each part of the crusher is accessible for quick and easy cleaning.





LABORATORY CRUSHING ROLLS

First designed especially for laboratory sampling work, Sturtevant Crushing Rolls are used regularly in many plants where there are limited outputs. Range of output for the 8 x 5 size is from ½ in. to 20 mesh — and for the 12 x 12 size from ⅝ in. to 20 mesh.

LABORATORY SAMPLE GRINDER

Laboratory Sample Grinders are of the "Open-Door" disc type and are capable of very fine work, producing products as fine as 100 mesh (coarser if desired) when working on dry, friable, soft or moderately hard materials. Simply turn hand wheel to provide product regulation from 10 to 100 mesh.

The only sure way to maintain strict quality of products is laboratory control . . . and that calls for accurate sampling.

Sturtevant Laboratory Equipment meets the exacting requirements of laboratory work. They are fast and accurate . . . provide true samples.

Rugged and dependable, Sturtevant equipment actually has all the features of full size machines plus extra accuracy and wider range of adjustment. The "Open-Door" accessibility permits quick, thorough cleaning . . . prevents the possibility of previous batches from contaminating new samples.

Investigate Sturtevant equipment for your laboratory. It will cut your sampling costs . . . help maintain strict quality of products . . . increase sales. Write for complete details and catalog.

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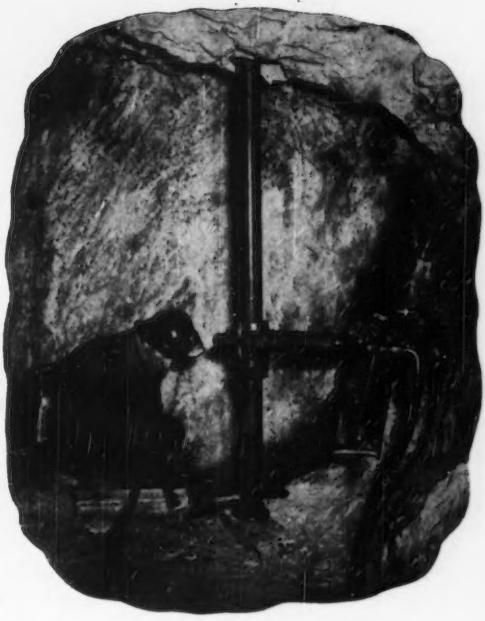
Designers and Manufacturers of: CRUSHERS • GRINDERS • SEPARATORS • CONVEYORS • MECHANICAL DENS and EXCAVATORS • ELEVATORS • MIXERS

just set 'er up



and let 'er go!

Watch a Gardner-Denver Continuous Feed Drifter in action. The operator merely sets 'er up and spots the hole—the drill does the work—fast! Self-adjusting feed responds automatically to bit penetration—is regulated by the type of ground being drilled. Maximum drilling speed is maintained at all times, as time-wasting manual adjustments are not necessary. The long-wearing "slow-motion" piston feed motor uses but 3% to 5% of the total air consumption of the drill. Write today for complete information.

Notice the centralized controls—the single air hose—the simple, single-column set-up.

GARDNER-DENVER CF89H Continuous Feed Drifter.

GARDNER-DENVER *Since 1859*

Gardner-Denver Company, Quincy, Illinois

In Canada: Gardner-Denver Company (Canada) Ltd., Toronto, Ontario

Amsco Ball Mill LINERS

Because the ores and materials handled in milling differ so widely in their impact and abrasive characteristics . . . American Brake Shoe Company supplies liner castings in a variety of outstanding wear resistant alloys:

Amsco 13% Manganese Steel—for use where impact is medium to very heavy or liner design is intricate. Surface work-hardens under impact, while body remains tough and shock resistant. If breakage is a problem, it is almost a sure sign that parts should be made with austenitic manganese steel.

Amsco "Chrome-Moly" Steel—for mill conditions of light to medium impact, with medium abrasion. This alloy has proved consistent in its wear-resistant characteristics, the result of fully controlled formula and heat treatment. Typical applications include small diameter mills, mills operating at slow speeds, or mills charged with small balls.

ABK Metal (Ni-Hard)—where operating conditions involve a high degree of abrasion and very light impact.

• • •

For example, in a Colorado gold mine heat treated alloy steel liners ground 87,838 tons of ore, while Amsco 13% manganese steel liners ground 131,729 tons. At a copper mine standard manganese steel liners cost .74 cents per ton milled, while Amsco "chrome-moly" liners cost only .68 cents. All field studies prove the important point that selection of the best alloy should be controlled by the impact and abrasion conditions in the mill. For further information on this subject, send for our free 12-page booklet, "Alloy Steels for Ball Mill Liners and Grates."

Feed head for 9'6" x 32' compartment mill, showing manganese steel segmental liners and throat liners.

AMERICAN Brake Shoe COMPANY

AMERICAN MANGANESE STEEL DIVISION
CHICAGO HEIGHTS, ILL.

Foundries at Chicago Heights, Ill., New Castle, Del., Denver, Colo., Oakland, Calif., Los Angeles, Calif., St. Louis, Mo.
Offices in principal cities. In Canada: Joliette Steel Limited, Joliette, Que.

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FROM TIREX PORTABLE CABLES

Simplex-TIREX Portable Electric Cables are carefully designed with an eye opened wide to the exacting and, very often, abusive conditions under which they must work. Toughness, flexibility, and safety are given top consideration and the result is a cable construction suited to day-in, day-out operation wherever the going is tough.

Check the advantages of this construction now. Keep them in mind. And next time you need cables for use on any portable electric equipment from hand tools to heavy shovels, remember to specify TIREX and profit by the dependable, low-cost cable service these features provide.

Conductors of TIREX Cables consist of small copper wires properly stranded together to provide non-kinking flexibility.

Conductor Insulation is a rubber compound having stable electrical properties and the mechanical strength necessary to withstand rough usage.

An **Inner Jacket** of durable rubber applied over the assembled insulated conductors forms the inner part of a tough protective covering for TIREX Cables. It provides a cushion for the conductors and protects them from mechanical shock whenever a cable is twisted or crushed.

Two **Seine Twine Serves**, hard-twisted for strength, are wound over the inner jacket to reinforce the protective covering and give it added wearability.

An **Outer Jacket** of Selenium Neoprene completes the construction. During vulcanization it is fused with the inner jacket and seine twine serves to produce a single, reinforced covering that is unexcelled for protection against abrasion, corrosive chemicals, weather hazards, sunlight, heat, and flame. It is not easily cut or worn and assures safe handling.

Simplex-Tirex

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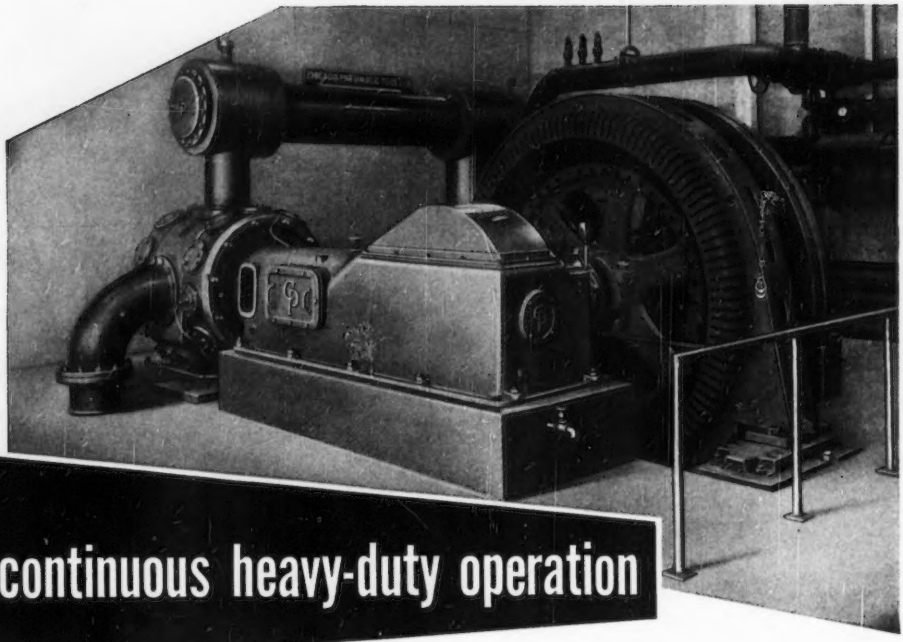

for continuous heavy-duty operation

O-CE COMPRESSORS

When the demand is for a continuous, economical supply of air, the CP motor-driven O-CE COMPRESSOR is unsurpassed.

Quick-acting Simplate valves minimize power consumption and provide high volumetric efficiency. Large, stream-lined air passages make air flow resistance negligible. CP Multi-Step Control handles partial load demands economically. CP Intercooler assures maximum heat transfer with low water consumption. CP Automatic Starting Unloader completely unloads compressor when starting and stopping.

The CP heavy-duty, conservatively rated Class O-CE Compressor is of the horizontal, double-acting, water-cooled type, with direct-mounted synchronous motor drive; in sizes up to 1,750 h.p., for pressures up to 5,000 pounds.

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DIESEL ENGINES • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

NEW RPM DELO OILS
cut engine wear-rate up to 85%

New RPM DELO Lubricating Oils contain advanced, special compounding. Proved in actual operation, they keep engines cleaner, increase protection and extend overhaul periods of all heavy-duty engines.

Cut liner wear rate up to 85%. In service under extreme operation conditions, these new RPM DELO Oils reduced wear-rates up to 85% over conventional heavy-duty type lubricants.

Reduced engine deposits as much as 75%. Superior compounding in new RPM DELO Oils kept top-ring grooves, oil rings, and skirt areas of pistons remarkably clean in high-temperature, high-output truck and tractor engines.

Saved 40% to 60% on maintenance. Records show that new RPM DELO Oils cut maintenance costs as much as 60%, reduced oil consumption 30% to 50% over the long run.

Proved in full range of engine service. This new line covers normal to extremely severe conditions. The grade that meets your needs will double protection against lubrication failures, give you all-around better engine performance.

RPM DELO Heavy Duty Lubricating Oil
A new, high quality-level compounded oil recommended for heavy-duty diesel or gasoline engines in normal to difficult service. (Meets U. S. Army Specification 2-104B.)

RPM DELO Special Lubricating Oil
Companion product to RPM DELO Heavy Duty Lubricating Oil. Has higher viscosity index for special operating conditions. (Also meets U. S. Army Specification 2-104B.)

RPM DELO Supercharged—1 Lubricating Oil
An entirely new product of higher quality-level than the products above. Fortified with new, more powerful compounding. Recommended for severe and abnormal engine service. (Meets U. S. Army Specification 2-104B, Supplemental List No. 1.)

RPM DELO Supercharged—2 Lubricating Oil
Highest quality-level oil, designed for extremely severe operating conditions. (Meets U. S. Army Specification 2-104B, Supplemental List No. 2, also the rigid requirements of Caterpillar Tractor Company's Superior Lubricants—Series 2.)

Send for the full report on new RPM DELO Oils. Actual test data furnished free. For complete information and the name of your nearest Distributor, write to any of the companies listed below.

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New and more Efficient Compounding keeps engines cleaner, increases protection, extends overhaul period

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Rubber and Metal Parts Interchangeable

Outstanding features of the WILFLEY pump include complete interchangeability of parts—from rubber to metal, or metal to rubber. Other exclusive features of design and construction, pioneered and developed by WILFLEY, give you stepped-up production, lower handling costs, and a proven dependability recognized by engineers all over the world. Wear parts are available in rubber, electric furnace iron and other materials individually engineered for every application. An economical size for every purpose. Write or wire for complete details.

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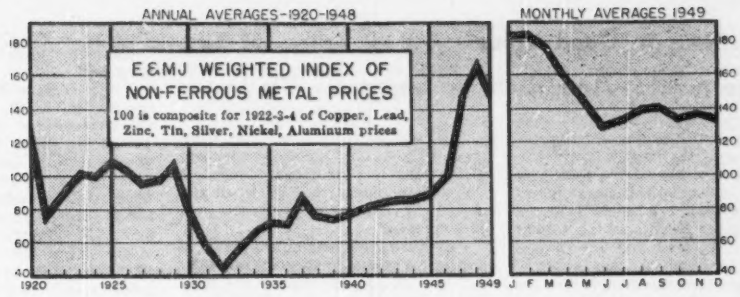
E&MJ OUTLOOK

PRICES



MARKETS

Steady demand supported most non-ferrous metal markets through December. The E&MJ price index for the month declined to 136.18, against November's 138.18. Lead and tin averages were lower.

Copper deliveries, totaling about 100,000 tons for December, will probably hold this high level through March, at least. **Buying interest in lead** revived, with consumers taking nearly all current lead sold. The Government's stockpile still is a strong supporting factor. **Zinc advanced** ¼c. to 10c. as December ended. The tin market remained unsettled on uncertainty over the intentions of the governments now concerned with it.

Look for **stiffer competition** in metal markets this year.

LABOR

With peace in prospect for industry generally in 1950, mining stands out as a potential sore spot. Inter-union squabbles will start it.

CIO Steelworkers, **striking at New Jersey Zinc,** are holding out for more than the steel companies granted. There's no sign of settlement.

AT HOME

Like an amateur symphony orchestra plowing through Beethoven's Fifth, the mining industry is grinding discordantly up to some kind of climactic action. Here's how it sounded as 1949 ended:

On subsidies, S. 2105 seemed headed for a veto if passed as it stood. Congressman Engle was weighing the merits of backing S. 2105 or of dropping it and tossing in his own subsidy bill once more. **Truman mystified many** by his seeming willingness to back tax reform for mining as a stopper for subsidy legislation.

But the Treasury said it was against any kind of tax reform that cut Uncle Sam's income, and then threw a scare into mining companies by questioning the principle of **percentage depletion.** Mining men, who tried to unify industry opinion, faced a thorny tangle of conflicting views on tax reform, and the outlook generally.

Despite this dissonance, a real drive to give the mining investor a better run for his money is slowly taking shape. Its object will be to reverse the steady decline in available venture capital. Small enterprises should benefit the most.

Actually the **outlook for 1950 is bright,** with general business activity, and therefore mining activity, likely to hold at near-1949 levels.

ABROAD

Recent press items notwithstanding, Labrador Mining & Exploration Co. says that the manganese discovery in Labrador will require more work before its practical importance can be determined.

Lepanto Consolidated, in the Philippines, could become a first-rank copper mine. Visitors report impressive, and growing, reserve figures.

MARKETS—Trends and Prices

Copper Sales in Good Volume — Most Sellers of Zinc Lift Price to 10c. — Lead Demand Improves — Tin Lower

OPERATING ON THE assumption that the first quarter of the new year will witness a continuation of the high rate of general industrial activity of recent months, consumers purchased copper and zinc rather freely and the volume of business in lead and tin showed improvement during the last month of 1949. Copper and zinc were firm as the year ended, with lead steady and tin unsettled.

Excepting foreign silver, prices of the more important non-ferrous metals ended the year at substantially lower levels than those named as 1949 opened.

The E&MJ index number of prices declined in December to 136.18, which compares with 138.18 in November and 185.52 in January. Lower monthly averages for lead and tin accounted for the loss. Our yearly index dropped from 168.38 in 1948 to 151.97 in 1949.

Copper Still Active

Sales of copper to domestic consumers for December shipment totaled more than 100,000 tons, an excellent showing, which assures the industry of another month of above-average deliveries. There appeared to be no opposition to the 18½c. quotation established early in November. The undertone of the market was firm.

Production of refined copper in the United States in November totaled 92,688 tons, against 86,882 tons in the preceding month. Deliveries to customers totaled 118,146 tons in November, which was higher than estimated consumption and probably reflected some buying for inventory. The supply situation in special shapes remained tight. Total supply of copper, thanks to imports, remained satisfactory.

Mine output of copper in the United States has been increasing, totaling 67,675 tons in November. This compares with 62,775 tons in October and 57,460 tons in September. Kennecott Copper announced that its Utah and Nevada divisions have returned to a 48-hour week.

Fabricating plants shipped products during November that contained 108,978 tons of copper, making the total for the Jan.-Nov. period 970,801 tons, which compares with 1,292,591 tons in the eleven months of 1948.

Lead Steady at 12c.

Stockpile purchases absorbed a good tonnage during December, which served to steady the market and the price was maintained at 12c., New York, throughout the month. Consumers showed a little more confidence in the outlook and a moderate buying movement set in before the year ended. However, offerings of foreign metal continued to obscure the price situation for the long term.

In a statement on the lead situation, Andrew Fletcher, president of St. Joseph Lead Co., estimated domestic mine output for 1949 at around 400,000 tons, against 385,000 tons in 1948. Recovery of lead from secondary sources amounted to about 380,000 tons for the year, which compares with 475,000 tons in 1948. Imports of lead contained in ore and metal was estimated at 400,000 tons for 1949, against 340,000 tons in the preceding year.

Consumers were warned by the American Smelting & Refining Co. against the purchase of lead, apparently originating in Japan, which is being marketed in this country under the name of "Selby" lead. The material, obviously not produced at the company's Selby plant, carries an excessive content of impurities and the marking is an infringement of the trademark, a spokesman for the company said.

Zinc became quite active toward the end of the month on rumors that the price would rise. On Dec. 28, a midwestern producer announced that its quotation had been advanced one-quarter cent to 10c., East St. Louis. Several other producers soon followed, but the move was not unanimous. Our zinc quotations for the last few days of the month reflect this uneven price situation. Most observers expect the price to become firmly established at the 10c. level after the turn of the year. Galvanizing operations will continue at a high rate over the first quarter of 1950, steel authorities contend.

Owing to the strike at the Palmerton plant of the New Jersey Zinc Co., the supply situation in Special High Grade zinc remained tight.

Higher handling and freight charges brought on a general increase in the premiums or differentials on Regular High Grade to 1.10c. per pound, and on Special High Grade to 1.25c. per pound. In most instances

Yearly Average Prices—1945-1949

(E. & M. J. Averages)

	1945	1946	1947	1948	1949
Copper, domestic, f.o.b. refinery	11.775	13.820	20.958	22.038	19.202
Copper, export, f.o.b. refinery	11.700	14.791	21.624	22.348	19.421
Lead, common, New York	6.500	8.109	14.673	18.043	15.364
Lead, common, St. Louis	6.350	7.957	14.470	17.843	15.172
Zinc, Prime Western, St. Louis	8.250	8.726	10.500	13.589	12.144
Tin, Straits, New York	52.000	54.544	77.949	99.250	99.336
Silver, foreign, New York	51.928	80.151	71.820	74.361	71.930
Quicksilver (per flask 76-lb.)	$134.889	$98.241	$83.742	$76.489	$79.458
Antimony, domestic, New York	15.839	17.306	34.852	38.168	40.229
Platinum, refined	$35.000	$57.199	$59.087	$86.252	$73.360
Cadmium (producers' quotation)	90.000	109.022	171.780	182.554	200.000
Aluminum, 99 plus percent, ingot	15.000	15.000	15.000	15.733	17.000
Magnesium, ingot	20.500	20.500	20.500	20.500	20.500

Average Prices for December (E&MJ Quotations)

Copper:	
Electrolytic, Domestic, Refinery	18.200
Electrolytic, Export, Refinery	18.425
Lead:	
Common, New York	12.000
Common, St. Louis	11.800
Silver and Sterling Exchange:	
Silver, New York, per oz.	73.250
Silver, London, pence per oz.	64.000
Sterling Exchange, "Checks"	279.750
Zinc:	
Prime Western, East St. Louis	9.753
Tin:	
New York, Straits	79.038
New York, 99% min.	(e)78.038
Gold, per oz. U.S. price	$35.000
Quicksilver, per flask	$71.000
Antimony, (E&MJ) (d)	35.280
Antimony, bulk, Laredo	32.000
Antimony, in cases, Laredo	32.500
Platinum, refined, per oz.	$69.000
Cadmium (a)	200.000
Cadmium (b)	207.500
Cadmium (c)	215.000
Aluminum, 99% plus, ingot	17.000
Magnesium, ingot	20.500
Nickel (f)	40.000

Domestic quotations, unless otherwise stated, are in cents per pound. Sterling exchange, checks, in cents. Quicksilver, per flask of 76 lb.

(a) Cadmium average based on the producers' quotation.

(b) Cadmium average based on the average of the producers' and platers' quotation.

(c) Cadmium average based on platers' quotation.

(d) Domestic, 5 tons or more but less than carload lot, packed in cases, f.o.b. New York.

(e) Tin contained.

(f) F. o. b. Port Colborne, U. S. duty included.

the rise became effective on January forward business.

Tin prices continued to fall because of a top-heavy supply situation. Prompt delivery tin of Straits quality declined during the month from 85c. per pound to 77½c. The RFC was an important factor in the domestic market. Importers who expect that all government intervention would cease now that controls have been removed were disappointed. Moreover, the stockpiling program is likely to become more of a factor before long, which should exert an influence on the market whether the operations are conducted openly or off the record.

World mine production of tin in October was estimated by the Tin Study Group at 13,400 long tons, or 200 tons more than in September.

General imports of quicksilver in the third quarter amounted to 58,458 flasks, most of which went into the stockpile. Domestic mine output in the July-Sept. period totaled 1,300 flasks. The price in New York was unchanged at $71 per flask of 76-pounds. Demand from consumers was moderate.

Silver of foreign origin was unchanged all month at 73¼c. an ounce troy. Withdrawal of silver by the Bank of Mexico was a supporting factor.

Revival of activity in the steel industry was reflected in an improved market for manganese ore. The operating rate of the steel industry in the last week of the year was slightly higher than 93% of capacity, equivalent to 1,716,300 tons of ingots and castings in the seven-day period.

(Continued on page 83)

Major Metals

U. S. DAILY AND AVERAGE PRICES

Dec. 1949	Electrolytic (a) Domestic	Copper (b) Export	Straits Tin New York	Lead New York	Lead St. Louis	Zinc East St. Louis
1	18.200	18.425	83.000	12.000	11.800	9.750
2	18.200	18.425	81.000	12.000	11.800	9.750
3	No Market	18.425	81.000	12.000	11.800	9.750
5	18.200	18.425	81.000	12.000	11.800	9.750
6	18.200	18.425	81.000	12.000	11.800	9.750
7	18.200	18.425	81.000	12.000	11.800	9.750
8	18.200	18.425	79.000	12.000	11.800	9.750
9	18.200	18.425	79.000	12.000	11.800	9.750
10	No Market	18.425	79.000	12.000	11.800	9.750
12	18.200	18.425	79.000	12.000	11.800	9.750
13	18.200	18.425	79.000	12.000	11.800	9.750
14	18.200	18.425	78.750	12.000	11.800	9.750
15	18.200	18.425	78.750	12.000	11.800	9.750
16	18.200	18.425	78.750	12.000	11.800	9.750
17	No Market	18.425	78.750	12.000	11.800	9.750
19	18.200	18.425	78.250	12.000	11.800	9.750
20	18.200	18.425	78.250	12.000	11.800	9.750
21	18.200	18.425	78.000	12.000	11.800	9.750
22	18.200	18.425	78.000	12.000	11.800	9.750
23	18.200	18.425	78.000	12.000	11.800	9.750
24	No Market	18.425	78.000	12.000	11.800	9.750
26	Holiday	Holiday	Holiday	Holiday	Holiday	Holiday
27	18.200	18.425	78.000	12.000	11.800	9.750
28	18.200	18.425	78.000	12.000	11.800	9.750
29	18.200	18.425	77.500	12.000	11.800	9.815
30	18.200	18.425	77.500	12.000	11.800	9.775
31	No Market	18.425	77.500	12.000	11.800	9.750
			AVERAGES FOR MONTH			
Dec.	18.200	18.425	79.038	12.000	11.800	9.753
			AVERAGES FOR WEEK			
Dec.						
7	18.200	18.425	81.333	12.000	11.800	9.750
14	18.200	18.425	78.958	12.000	11.800	9.750
21	18.200	18.425	78.458	12.000	11.800	9.750
28	18.200	18.425	78.000	12.000	11.800	9.750
			CALENDAR WEEK AVERAGES			
Dec.						
3	18.200	18.425	83.333	12.000	11.800	9.750
10	18.200	18.425	80.000	12.000	11.800	9.750
17	18.200	18.425	78.833	12.000	11.800	9.750
24	18.200	18.425	78.083	12.000	11.800	9.750
31	18.200	18.425	77.700	12.000	11.800	9.768

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

Dec. 1949	Sterling Exchange "Checks"	Silver (c) New York	Silver (c) London	Gold London	Gold (d) United States
1	279.750	73.250	64d.	248s.	$35.00
2	279.750	73.250	64d.	248s.	35.00
3	(e)	(e)	(e)	(e)	35.00
5	279.750	73.250	64d.	248s.	35.00
6	279.750	73.250	64d.	248s.	35.00
7	279.750	73.250	64d.	248s.	35.00
8	279.750	73.250	64d.	248s.	35.00
9	279.750	73.250	64d.	248s.	35.00
10	(e)	(e)	(e)	(e)	35.00
12	279.750	73.250	64d.	248s.	35.00
13	279.750	73.250	64d.	248s.	35.00
14	279.750	73.250	64d.	248s.	35.00
15	279.750	73.250	64d.	248s.	35.00
16	279.750	73.250	64d.	248s.	35.00
17	(e)	(e)	(e)	(e)	35.00
19	279.750	73.250	64d.	248s.	35.00
20	279.750	73.250	64d.	248s.	35.00
21	279.750	73.250	64d.	248s.	35.00
22	279.750	73.250	64d.	248s.	35.00
23	279.750	73.250	64d.	248s.	35.00
24	(e)	(e)	(e)	(e)	35.00
26	Holiday	Holiday	Holiday	Holiday	Holiday
27	279.750	73.250	Holiday	Holiday	35.00
28	279.750	73.250	64d.	248s.	35.00
29	279.750	73.250	64d.	248s.	35.00
30	279.750	73.250	64d.	248s.	35.00
31	(e)	(e)	(e)	(e)	35.00
		MONTHLY AVERAGES			
Dec.	279.750	73.250	64.000d.	—	35.00
		AVERAGES FOR WEEK			
Dec.					
7	279.750	73.250	—	—	—
14	279.750	73.250	—	—	—
21	279.750	73.250	—	—	—
28	279.750	73.250	—	—	—

Calendar week averages, New York Silver: Dec. 3rd, 73.250; 10th, 73.250; 17th, 73.250; 24th, 73.250; 31st, 73.250.

(e) No market (Saturday).

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.300c. per pound, the average differential for delivery charges.

(b) Our export quotation for copper reflects prices obtaining in the open market and is based on sales in the foreign market reduced to the f.o.b. refinery equivalent, Atlantic seaboard. On f.a.s. transactions we deduct 0.075c. for lighterage, etc., to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingot bars; cathodes are sold at a discount of 0.125c. to 0.15c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East and Middle West command a premium of 1.10c. per pound over the current market for the Prime Western; Special High Grade 1.25c.

Quotations for lead are for common lead. Corroding lead commands a premium of 10 points.

(c) The daily New York silver quotation reported by Handy & Harman is for silver contained in ores and other unrefined silver-bearing materials, in cents and one-eighth cent fractions per troy ounce. It is determined by Handy & Harman on the basis of actual sales of bar silver .999 fine in amounts of 50,000 ounces or more for nearby delivery at New York, and is usually one-quarter cent below the price paid for such bar silver, this deduction being the allowance for carrying, delivering, and marketing. In addition to foreign silver, the quotations also apply to domestic and Treasury silver if such silver enters into the New York market.

The Treasury's purchase price of newly mined domestic silver 90.5c. per troy ounce 1000 fine, effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

Behind the By-Lines . . .

G. P. Lutjen

» **Last month's** Operating Idea on teaching bunch blasting (p. 139) proved very disturbing to our copy editor, **Frances Brooke.** She made it plain that she found the idea of "spitting" 3,000,000 holes a year pretty disgusting. One of these days we'll explain it to her.

We may as well confess now. Somebody will spill the beans sooner or later anyhow. Mike Zedonek, hero of our mighty saga, "Indoctrination Program Pays Off" (p. 58), wasn't hired the day we took all those pictures of how he was hired. As a matter of fact, Mike was already working at the Perth Amboy smelter, that bleak September day we first cased the place.

But we wanted to show this excellent program for training new men, in action, and it looked a lot easier to re-enact the procedure than to hover around the front gate until a likely candidate came along looking for a job.

So we wrote a script and **Jim Auburn** and **Gil Augustine** of the Personnel Department at Perth Amboy volunteered as casting directors. On the big day, McGraw-Hill's ace photographer, **Dick Wolters,** went to work with his camera while we burned our fingers handling flash bulbs.

We might add that we're sorry this Hollywood production ended so soon. Now we'll have to stop opening conversations with, "How would you like to be in pictures, little girl?"

» **Citizens of Leadville, Colo.!** Don't be surprised if the Resurrection mill disappears overnight. You certainly won't be when you read about the fearful concoction with which they plan to dose their sulphide ore. It probably contains everything but ipecac (whatever that is) and sounds like something you would find in a Witch Doctor's Manual. Apparently standard recipes didn't work in extracting the fine gold in the ore, so the Resurrection people were driven to extremes, such as those on page 71.

» **There's some** interesting information on selective grinding at Bunker Hill on page 64. When they found that some lead and zinc could be obtained from coarse feed, the practice of grinding all material down to fines came to a screeching halt. Incidentally, the Bunker Hill mill men worked out the flow sheet while a gang of men were busy tearing down the old mill and building a new structure around it. Didn't disturb so much as a bubble on the flotation froth.

Author **Frank McKinley** was a member of the class that left the mining schools in the cold, bleak year of 1931. In view of the circumstances he went to work in the Morning mine as a mucker, the only way, one school of thought contends, to learn anything at all about any part of mining. Be that as it may, he's now back in the milling business as assistant mill superintendent at Bunker Hill.

» **In the August issue** of E&MJ **Douglas H. Eldridge,** after a thorough study of the Hoskold formula, felt justified in figuratively throwing stones at it. In this issue, **Franklin G. Pardee** of the Michigan Geological Survey picks up those stones and throws them back (p. 76). You've had the con, now here's the pro.

» **If you think** you've got materials handling problems, you should take a look at Freeport Sulphur Co.'s problems at its Grande Ecaille property in the Louisiana marshes. That area just never did make up its mind whether it would be land or water. Each employee travels about 5,000 miles a year by boat just going to and from work.

A. A. Gustafson, who spends a lot of time wrestling with the materials problem down there, tells how they solved some of their difficulties on page 68.

» **Two of our old E&MJ** departments were given a new suit of clothes in this issue. What used to be Equipment News is now **New Products Digest,** streamlined a little to serve you better.

Regional News has been revamped as **This Month in Mining.** In addition to covering mining operations all over the world, interesting properties or plants will be featured, plus occasional reports on developments. For example, take a look at the E&MJ Report on **page 128.**

» **Last month's mail** contained a letter from **Fred Crosby** at Magma Copper. It said in part:

"We of Magma Copper Company, as elsewhere in the mining profession, are ever on the alert for useful suggestions or ideas that will simplify or improve present methods. Your pages on Operating Ideas are therefore read with considerable interest and occasionally ideas are presented that find useful applications.

"In appreciation I wish to submit two useful operating ideas that have proved very successful in our operations." (Pp. 86, 88.)

An industrious Utah beaver led the way to one of the state's richest discoveries of fluorspar. While digging for his dam in Juab County, the beaver flipped out some fragments of loose ore. Later excavations turned up deposits that can indefinitely take care of Utah's up and coming steel industry.

» **Veteran alchemists** and sorcerers were probably glad to hear that gold can now be made out of a mercury isotope. All you have to do is separate mercury-196, which incidentally is scarcer than gold, from ordinary mercury. This in itself is a long and expensive process. (And if the Government says it's expensive, brother, it's expensive.) Then you bombard this mercury-196 with neutrons for weeks to change less than 5% of it to gold.

On the whole it would probably be easier to tunnel over from your present diggings and drive a raise into Fort Knox.

ENGINEERING AND MINING JOURNAL

JANUARY, 1950

Get Moving On Tax Incentives

IF YOU WANT your organization and the mining industry to have a chance to demonstrate under a free-enterprise system that ours is not a have-not nation, get moving! Be you workman, engineer, manager, or manufacturer serving the industry, you have a big stake in the creation of a tax climate that will encourage capital to take more mining risks. In the face of present Government expenditures, no such climate will be created unless Washington, particularly your representation in Congress, hears from the grass roots in compelling volume that the need for tax incentives is of vital importance. They must be made to understand that not only you and our industry, but your community and the nation will benefit, and in the final analysis total tax revenues will be increased, not decreased. Ask them where they expect to collect their taxes if they handicap the development of fundamental new wealth by the mining industry.

It is not enough to write or talk to your members of Congress by yourself. Ask the others of your organization to make themselves heard, the workmen in your mine or plant, and the leaders of your local community. All of them will suffer if the mining industry, depleting reserves every day it produces, is hindered in exploring and developing new reserves. The nation and the Western World will not be secure if venture capital does not flow into the establishment of such reserves. Facing the present tax structure and the risks inherent in mine development, it is impossible for venture capital to get a run for its money.

Who is the venture capitalist whose willingness to assume financial risk is so vital to a healthy private-enterprise system? He is Joe Spivak who is sure that driving only 50 feet more on that prospect adit in Maverick Canyon will find a bonanza. He is the small-town merchant who stakes Joe to make the test. He is the heir to millions who can afford to take the big shot for big game. He is the manager of corporate funds who proceeds with all the safeguards that organized effort and science can provide. He is millions of ordinary people who will take a chance now and then. But all have in common one thing. They want a run for their money, impossible in a heads-I-win, tails-you-lose tax climate.

What measures will give these venture capitalists a run for their money? Exemption from taxes for the new mining venture for the first five years of profitable life. The right for stockholders of mining companies to enjoy corporate profits without double taxation as both corporate and private income. The full right to charge losses against income, carried back two or forward five years. Reduction of taxes on capital gains from mining ventures. The right of investors to claim tax credits for a substantial portion of their investments in new mining ventures. Not one, but all of these. It is a time for drastic measures, not mere palliatives.

The prophets are out in force these days and the consensus is that 1950 will probably be a pretty good business year, partly because Government's disbursement of your tax money contributes very heavily to the total of personal incomes. We are trying sincerely to see possible virtues in this new state of affairs and should like to see the fullest enjoyment of social security that can be soundly financed. However, we cannot escape the conclusion that what is to be enjoyed must be produced by someone, and that it is dangerous to create a situation where the main reward for extra effort goes to someone else than the producer himself. Much as we would like to believe that pie in the sky is simply wonderful, we fear that there will be a day of reckoning, and that the longer it is postponed, the more unhappy will be the results. The wealth and strength of this country are so great that it may take us a long time to find out what New Zealand and Australia have already discovered, and what Britain is rapidly learning.

Thus if we really mean to obtain tax incentives to stimulate mining investments, the time to do so is now, before new deficit-spending policies make it impossible to contemplate even short-term and wholly beneficial tax relinquishments by the Treasury. Now is the time to make tax incentives to venture capital in mining your creed and crusade, to be shouted from the housetops, so that the rumble from the grass roots will compel Washington to listen!

What Price Subsidies for Mining?

AS AN EDITORIAL in our October issue made clear, we believe that there are certain conditions under which a Government subsidy to a mining operation may become justifiable. We believe strongly, however, that these conditions should be precisely defined and the field of application of the subsidy strictly limited, because of the very real threat to private enterprise in any attempt to combine in one industry both Government and private financing.

We believe also that the industry should study carefully the price it will pay for security under a subsidy system.

We have found it impossible to adopt a clear-cut attitude on this difficult issue simply because one cannot take a position completely for or against subsidies without ignoring certain impressive factors opposing either position. If one feels a moral responsibility to *all* the mining industry, one must attempt to reach a middle ground to which all apparently opposed principles can be reconciled.

Does the Industry Need Subsidies?

We have found it fruitless to canvass the industry in an attempt to evaluate the need for Government subsidies. There exist two groups of opinion on this question, widely separated. One holds that the mining industry is in a state of near-collapse; the other maintains that subsidies are utterly, unjustified.

The truth, of course, lie somewhere between. It is obvious that the industry is not collapsing, as witness the current production figures for the major metals. Exploration for new orebodies in this country is being pushed aggressively by those companies able to afford it.

It is equally obvious, however, that the bulk of production, and the major part of this exploration, arises from the activities of large and medium-sized mining companies. Many small and marginal mines have had to shut down, and to a mining company that is forced out of business, the industry *has* collapsed, whatever the current production statistics may prove.

It seems clear, therefore, that a fair statement would be that the mining industry as a whole does not need Government aid in the form of direct subsidy. On a long-term basis, the industry would be greatly helped by certain changes in Goverment handling of taxation and other problems, but that is another question.

Does the National Interest Demand Subsidies?

One must add to the foregoing statement, however, the fact that if several small or marginal mining enterprises are to survive, they must have help. They simply face an economic situation beyond their own power to handle.

Labor unions, for example, are forced to ignore the small miner who finds himself forced to match national, big-company wage and pension patterns, or go out of business.

The question then reduces to whether or not it is in the national interest that small or marginal mines should continue operating. Certainly the Government cannot assume the responsibility for maintaining solvent every person or group that feels like doing business. Unless a mining company's continued existence contributes materially to national security, it has no more right to a Government subsidy than a maker of bed linen.

There is no clean-cut answer to this question. We have found no statistical evidence on which one could base a flat reply. Our opinion is that it is in the national interest to keep in operation marginal properties where it can be shown that a shut-down for a long period would render it extremely improbable that they could recover later the rest of an important ore reserve.

With regard to small mines, the case is even less clear, yet we believe strongly that it is in the national interest to encourage small mining enterprises. The foundation of a healthy private enterprise system is a swarm of competing individual entrepreneurs and investors. Also, whenever an industry becomes composed solely of large corporations, complete Government control is waiting down the road.

Therefore it seems evident that the Government should do all that it can to encourage and assist the continuance of active small mining enterprises. But is a subsidy the best way to do that job? The price of embracing subsidies will unquestionably be great. Who can say at present if it will not eventually be too great?

The Price Will Be High . . . .

The price of a subsidy system has, of course, two aspects. One is the obvious burden that it would lay on the already heavily-laden taxpayer. The other is the less-evident and longer-range price that would be exacted from the industry in loss of freedom, in decline in efficiency, and in weakening of the industry's moral fibre.

In our opinion, the adoption of selective subsidies will definitely place the mining industry on the path to Government control. Progress on that path will be rapid if the Government's administrators are bent upon such an end. We believe such control will still be inevitable even if the men in charge are zealously anxious to avoid such a trend.

What's wrong with Government control? Are

Government employees less able or energetic than private functionaries? Generally, no. But Government is bureaucracy *par excellence*, and bureaucracy means interminable consultations and delays in making decisions. It means a mixture of political complications in every problem. It means a lack of reasonable incentives for energy or courage in decisions. The inescapable consequence of Government in business is a drastic loss in efficiency, and fewer benefits for all.

A second consequence of embracing selective subsidies is that the mechanism will inevitably gravitate toward cost-plus arrangements, and that the drive of competition toward greater efficiency will be lessened if not removed or reversed. This may seem of small concern to the individual operator, but the over-all costs in terms of the public interest are bound to be great.

Third, and of greatest individual concern, mining management gives up the major part of its role in collective bargaining when it takes a subsidy. Wage rates will be fixed by the Government administrator, because both employer and employee will know that he alone, with the subsidy he doles out, holds the whip hand over the enterprise.

Through wage control, the Government will steadily widen its power. Its administrators can not divorce themselves from politics, and the trend will certainly be to higher wages rather than lower. Protected by subsidies, a small mine's rising wage rates will crowd upward the rates at other, non-subsidized, mines in the area. The weakest financially of these mines will inevitably have to turn to subsidies too to meet this competition. This, in turn, will bring pressure to bear on other mines and the sphere of Government control will inexorably expand throughout the industry.

. . . . But We May Have to Pay It

Therefore we view the price of subsidies as appallingly large, both morally and physically. Why then not dismiss the whole issue on that basis?

Still thinking in terms of the public interest, we are afraid to destroy the protection given to domestic mining against foreign competition. Were peace assured, the case might be different, but we see nothing in the international outlook that tempts us to weaken the war potential of the United States.

Tariff in adequate amounts would yield the protection but can it be had? We think not, partly because the United States' stake in world well-being makes it necessary to abandon truly protective tariff as a general policy and partly because both the consumer voice in policy making and the political drift of the country make a protective mechanism which gives the most help to those who need it least unlikely to be adopted.

Tariffs, in short, cannot be looked to as a solution for the problems of the small or marginal enterprise. Possibly tax relief can, but there is no present assurance that it will be conceded.

For all we know, the trend toward socialism, now typified by the "welfare state" may be continued. If it does, taxation must grow larger instead of less, giving private enterprise no chance to develop its own cure. Small mining may continue to ebb. In such a situation, can we avoid subsidies despite the acknowledged price?

On balance, our attitude is that the inescapable price of a selective subsidy system makes it a pill to be swallowed only if the patient can be cured in no other way.

What Subsidies Should Avoid

Turning to the features of a subsidy arrangement that are most obnoxious and should be avoided if one is adopted, we hold that:

1. Special encouragement should be given to individual investors and small operators, but there should be no automatic provision for rides on the gravy train. Administrative checks on the merits of each individual project should be required.

2. Special emphasis should be given to exploration incentives and to situations where abandonment would probably result in permanent loss of the resource involved.

3. There should be a minimum of discretion granted to administrators, insofar as this principle is consistent with efficient administration.

4. The principal administrative appointment should be subject to Congressional confirmation.

5. More than nominal profits, i.e. a fair operating fee, should not be financed at taxpayers' expense. In the computation of this profit, or fee, depletion allowances in excess of cost should be granted only if committed to exploration.

6. Beyond the inventory indicated by military requirements, the purchases under the subsidy program should be liquidated in good times without any arbitrary limitations, such as acquisition costs. If the Government stockpile is allowed to build up indefinitely, the industry will never again enjoy firm prices.

Above all, let us avoid the sort of muddy thinking that calls for less bureaucratic control and for subsidies in the same breath. Subsidies *mean* bureaucratic control, whether the Government pays 5, 50, or 100% of your costs. If you decide to take the Government's money, at least do so in full realization of the price your industry will have to pay in return.

1 MIKE ZEDONEK, looking for work but slightly apprehensive, mounts steps to employment office. To see how Mike made out, follow the numbered photographs.

Indoctrination Program Pays Off

Enlightened two-point program rapidly makes new employee a part of the production team at A S & R's Perth Amboy smelter.

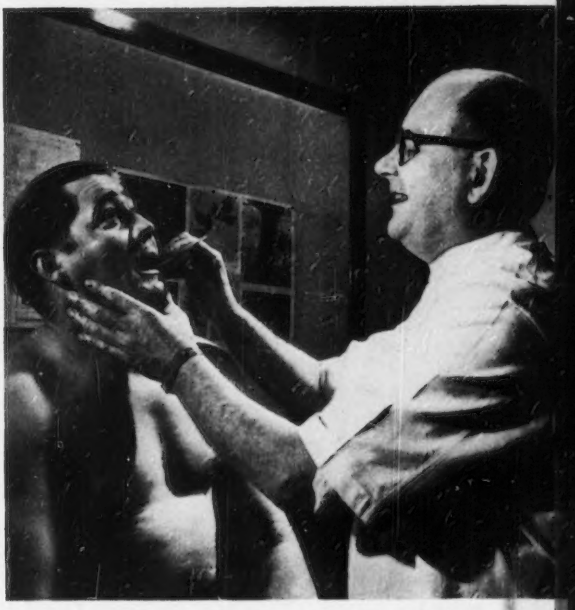
POINT 1. — Sincere and friendly indoctrination.

POINT 2. — Safety is "built into" every job.

RESULTS. — Lower hiring costs, fewer accidents, more goodwill.

DICK WOLTERS, Photographer, Business Week G. P. LUTJEN, Assistant Editor

2 "LET'S TALK IT OVER," says interviewer Malone. "Frankly, we're as anxious as you are to see you in a job you like." A few points interview brings out are: (a) Mike is an ex-coal miner; (b) the Yankees will probably win the pennant next season; (c) Mike went to high school for a year; (d) he'll probably do a good job. Next step is a physical check-up.



3 "SOUND AS A DOLLAR," is Dr. M. F. Urbanski's verdict, although he kids Mike about some excess pounds. The doctor is well-known Perth Amboy surgeon who supervises the plant hospital. He's proud of his modern X-ray facilities and well-stocked pharmacy.

4 INFORMATION, PLEASE. Back at the office there are the usual multitude of forms to fill out as Mrs. Dorothy Johnson enrolls the new employee.

Right Man in the Right Job

J. V. Malone, as he does with all applicants, sizes up Mike's experience, education, physical capabilities and mental attitude. He checks what he finds against the positions currently vacant at the plant. In Mike's case, an industrial background plus a rugged frame add up to a job as anode tongsman in the plant's Copper Casting Department.

He notifies George Pastrik, copper casting foreman, that the replacement he requested last week will report to work tomorrow morning.

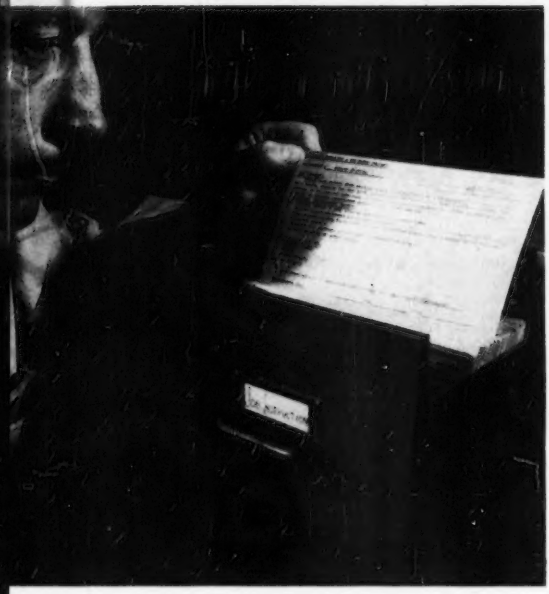
As for Mike—at the moment, his job is a slip of paper showing the department where he'll work, his foreman's name and what time to go to work. He feels better, though, than he did at 8:00 o'clock that morning and perhaps he's somewhat surprised that the Perth Amboy people have been so nice to a guy just looking for a job.

But Mike's in for an even bigger surprise when he goes to work the next day.

. . . (See next page.) ➞

5 "GLAD TO SEE YOU, MIKE. I'm George Pastrik, Copper Casting foreman. I'll show you how to get to our department. We got a couple of square miles here we don't want you to get lost in." Foreman Pastrik has come to meet Mike at the front gate. On the way to Copper Casting he tells Mike about his new job.

6 "THINGS CAN BE ROUGH in this business and we can't forget safety for a minute." The foreman explains that a green light goes up for each safely worked day of the month. If a disabling injury occurs, a red light goes up that day. "One thing," adds Pastrik, "The place is gettin' safer all the time."



9 JOB INSTRUCTION CARD is taken out of files by Foreman Pastrik while Mike is changing into his work clothes at his new locker. (See text at right.)

Packaged Instructions Build Safety into the Job.

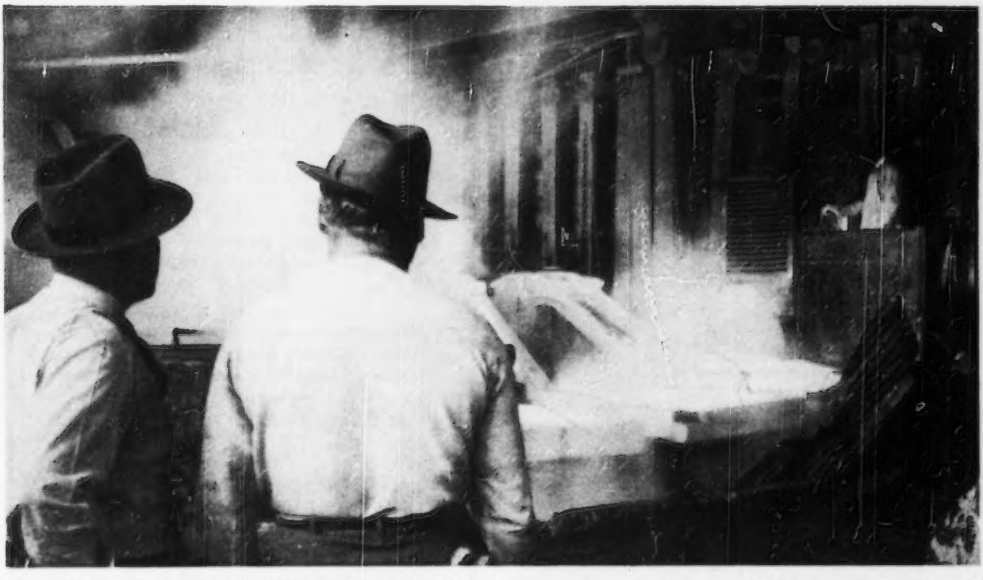
Copper Casting has a Job Instruction card for every position in the department. The card contains a general description of the job, a step-by-step procedure in doing the work, and a list of the tools involved. An important point is that all required safety equipment is listed as *necessary tools*. Gloves and goggles are considered to be just as much a part of certain jobs as picks and shovels.

Having instructions packaged on the Job Instruction card serves several purposes. It refreshes the foreman's memory and assures that he will leave out no point of instruction. The worker is also taught in exactly the same way each time. And he knows he is getting a thorough training.

Job Instruction accents the positive. Correct procedure is taught. If Mike gets off the beam at any point, instruction will begin again at that point, rather than place any stress on telling him what *not* to do.

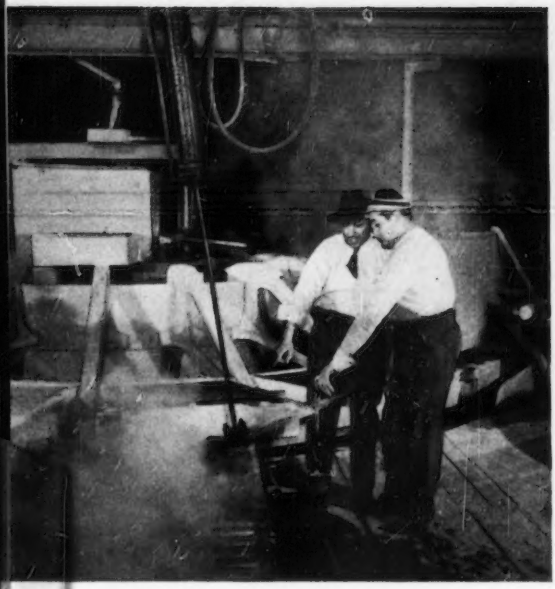
7 FOREMAN POINTS OUT LANDMARKS to Mike and gives him facts a new man should know about payday, lunch hour, days off. Mike learns that George Pastrik has worked here 23 years, guesses that he is an ex-GI. (Ed note: George Pastrik won three battle stars in the ETO.)

8 "CHARLEY HERE, IS A FIGHT FAN," Pastrik tells Mike as he introduces the new tongsman to the Copper Casting crew. One man was a semi-pro baseball player like Mike.

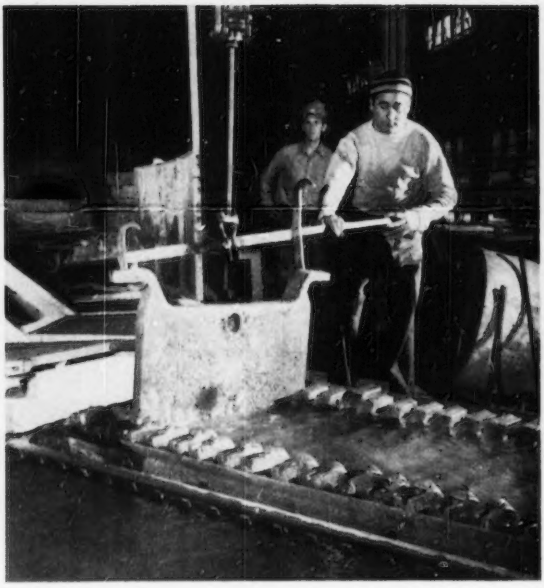


10 "THAT GUY WEARS AN ASBESTOS SUIT," Pastrik tells Mike, who is fascinated watching the metallurgist pour molten copper into the flat mold on the slowly turning wheel. Water sprays under the casting wheel cool the copper until it reaches a point diametrically opposite the metallurgist's ladle, where another man pries it loose. Someone slipped a hat on Mike when he violated safety rule by approaching working area without hat.

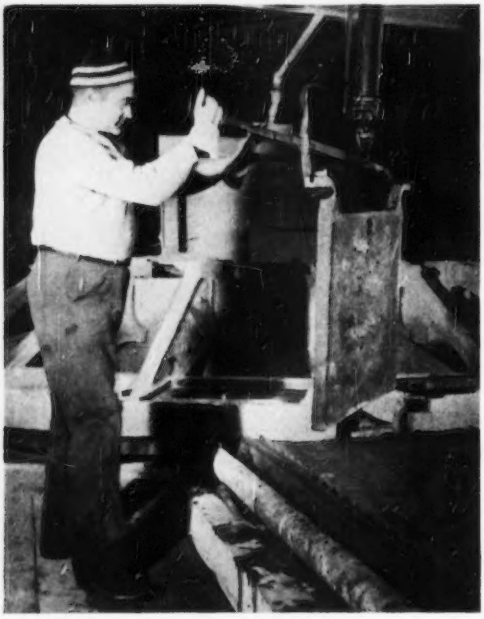
(Continued on next page)



11 "GETTING THE ANODE OFF THE WHEEL into the bosh is your job, Mike." The foreman goes over the process of using the air-operated tongs step-by-step. When able to repeat procedure faithfully and name the tools for the job, including hat and gloves,....



12 MIKE IS ON HIS OWN. He finds the job a little harder than he thought, but former tongsman, standing by, shows him the knack of hooking the anode and using his weight to swing it to the bosh.



13 IT'S EASY WHEN YOU KNOW HOW. By the end of the day Mike is confidently and methodically dunking the heavy anodes into the cooling tank.

Mike Makes the Grade

Mike proved an apt pupil. When George Pastrik had him sign a copy of the Job Instruction card to indicate that each point had been covered, he was certain that Mike had absorbed his teaching. If he had not been, Pastrik would have gone over the whole procedure with him again and again as necessary.

As it stands, George will check up on Mike from time to time in the weeks to come. If Mike at any time slips up in reviewing his instructions, or forgets that his gloves are a necessary tool for the job, then George Pastrik will have to retrain him.

At the end of the training period, Mike could not help but be impressed by the interest in his welfare and safety. It's a safe bet that Mike will be a good worker at Perth Amboy for many years. Most Perth Amboy employees are.

Sincere and friendly welcome is an important step in AS&R's indoctrination program at Perth Amboy, but a well-trained supervisor is the key to . . .

Making the Training Program Work

Mike Zedonek's experience, as pictured on the foregoing pages, didn't just happen. It is a procedure which greets all new men at AS&R's Perth Amboy refinery. Such a program takes effort and conscientious application, and the "Welcome,-glad-to-have-you-with-us" part of it cannot be ignored if success is to be obtained.

When it comes to results, the Perth Amboy people can point to a much lower than average labor turnover and reduced hiring costs per man. In addition they have found that induction on this basis makes the worker more receptive to safety training.

Safety training is based on the idea that unless a man receives thorough safety training as a part of his job training, he is not ready to do the job. Safety is a built-in part of the job rather than something extra added to it. This attitude gets a large part of the credit for an accident frequency record far below previous experience. By doing this job right the first time, much effort is spared in retraining the employee.

Responsibility for carrying out the program is on the Personnel Department and on the foreman.

First contact with the new employee is made by the Personnel Department. Here by careful prior study of requirements of each job in the plant, an attempt is made to place the applicant in the job for which his talent, experience and education best fit him. In addition the Personnel man gives the new worker the basic information he will need to know such as working hours, pay, union agreements, medical care, and other items important to the new man.

But the key to the entire program is the foreman.

One of the primary functions of the foreman or supervisor is the induction, breaking in and training of new employees. It is usually true that when a man is doing an unsatisfactory job, he has not been properly schooled in the details of the job. It is therefore important that the foreman himself be well trained to carry out his role as instructor.

He is given classes in which to learn his part in making the new employee an effective part of the production team. Afterwards he is given an outline of the entire program to achieve safe output. Safe output is made his responsibility in black and white.

Here are the seven steps in the program as they appear in the foreman's instruction manual. Each is built upon the preceding steps.

1 JOB METHODS AND TOOLS.
This means that by thorough study of the methods and tools used in doing the job, we can find out what kind of a person we need for the job and what his instructions will be.

(The foreman cooperates with the Personnel Department in cataloging this information.)

2 SELECTION AND PLACEMENT.
By careful selection of an individual and placing him on the job he is best suited for, as shown by Methods and Tools to be used, we reduce the chances of the worker going wrong because of improper placement.

(Most of the responsibility for placement is in the hands of the Personnel Department.)

3 JOB SAFETY TRAINING.
By knowing the contents, methods and tools of the job, we should have a package of instruction points which are a must in training the individual. Omission of a single point in the "package" leaves the job only partially done. Job trainers must be trained in the use of this "package." Supervisors must insist on the whole training job being done. All safety equipment are tools of the job in this "package."

(This is where the foreman steps in. For more about the "package," see page 60.)

4 JOB SAFETY HABITS.
This segment represents the safe works habits of the individual as demonstrated to the trainer and his supervisor. If the worker fails to make a habit of doing the job the safe way, he needs more training or retraining.

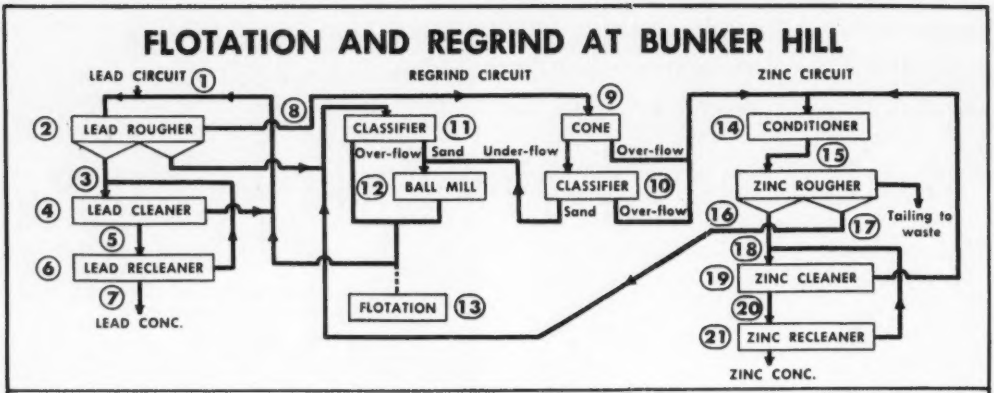
5 JOB RULES, ACCEPTANCE AND AGREEMENT.
This point is very essential. By eliminating the negative and accentuating the positive in our training, the worker learns to know what he should do and is not confused by the numberless things he should not do. His acceptance of the rules must be had. His agreement to their necessity must be had.

(Acceptance and agreement are obtained when the worker signs a copy of the job instruction card, indicating that all points of instruction have been covered and that he understands them.)

6 RELIABILITY AND COOPERATION.
This point is the end result. If the preceding five points are properly covered, the result should be a reliable and cooperative employee. He must be relied upon to do the job the safe way at all times even in the absence of the supervisor. His cooperation will be demonstrated in his willingness to follow instructions and to follow orders and suggestions even if he may question some part of same.

7 CHECK AND RE-CHECK.
This point is self-explanatory. To know if the program is working it is necessary to make constant checks and re-checks on the six preceding points. At any point where a check reveals a weakness, the supervisor must go back to that step where failure is found and retrain; then check and re-check again.

Foremen are reminded that "If the worker hasn't learned, the instructor hasn't taught."



LEGEND

1. Hydroseal B-41-1 pump, 6-in.; Wilfley, model C pump, 6-in.
2. Two banks, 14 cells each, 48-in. Agitair flotation machines.
3. Bucket elevator, 8x16-in.
4. Agitair, 4 cells, 36-in.
5. Bucket elevator, 8x16-in.
6. Agitair, 4 cells, 36-in.
7. Bucket elevator, 8x16-in.
8. Wilfley pump, 6-in., model C.
9. Cone, 8-ft.
10. Esperanza-type, dewatering classifier.
11. Dorr classifier, 6-20-ft., model D.
12. Hardinge ball mill, 8x3-ft.
13. Agitair, 4 cells, 36-in., for test work.
14. Two conditioners, 6x12-ft.
15. Two B-41-1 Hydroseal pumps, 6-in.
16. Two banks, 14 cells each, 48-in. Agitairs.
17. Two Hydroseal tailings pumps, 8-in.
18. Bucket elevator, 8x16-in.
19. Agitair, 4 cells, 36-in.
20. Bucket elevator, 8x16-in.
21. Agitair, 4 cells, 36-in.

THIS FLOWSHEET, which decreases sliming of sulphides, is the basis of the success of . . .

Bunker Hill's Flash Grind

What the flash grind is and how it improves metallurgy at Bunker Hill.

Contrary to what has for years been accepted grinding practice in the Coeur d'Alene lead-zinc flotation plants, Bunker Hill and the Sidney mills now use a coarse primary grind and get away with it. In fact, the lead and zinc content of the Bunker Hill tailing now runs about half what it used to.

Briefly, Frank McKinley's idea in developing the flash grind was to recover all valuable mineral at the coarsest possible size. He wanted to avoid grinding any sulphides beyond the minimum necessary for release because he felt that too much easily-ground sulphide was either being lost altogether or turning up in the wrong concentrates.

The flowsheet shown above was worked out after many months of test work. It does the trick. The data shown above at right give the results. The accompanying article gives the details of the new method that has given Bunker Hill these advantages:

1. **Overgrinding reduced.**
2. **Recovery increased.**
3. **Better lead-zinc separation.**
4. **Grinding capacity increased.**
5. **Water consumption cut.**
6. **Less pulp handled.**
7. **Flotation pulp density raised.**
8. **Reagent consumption reduced.**

FRANK McKINLEY
Assistant Mill Superintendent
Bunker Hill & Sullivan Mining & Concentrating Co.
Kellogg, Idaho.

PRIOR TO the evolvement and adoption of the milling method practiced currently at the Bunker Hill concentrator, Kellogg, Idaho, grinding was done in the conventional single-stage closed circuit arrangement. Finish grinding was accomplished in the ordinary closed circuit ball mill-classifier pattern, followed by flotation of lead and zinc.

After comprehensive laboratory investigation, it was determined that an important improvement in metallurgy could be obtained by following the grinding pattern to be described.

Bunker Hill ore is composed of individual rock particles which classify themselves into several ore fractions different from each other in matters such as specific gravity, hardness, size, metallic content, mineral ratio, mineral dissemination, and mineral particle size.

Table 1.

Mineral Composition of Bunker Hill Ore

Fraction of Mill Feed	Specific Gravity	Pb	PbS	Zn	ZnS	Fe	FeS	Quartzite
		Per Cent						
15%.....	6.36	60	69.3	5	7.5	5	10.7	12.7
50%.....	3.03	1	1.2	1	1.5	6	12.8	84.5
15%.....	3.30	3	3.5	4	6.0	8	17.1	73.4
5%.....	6.36	60	69.3	5	7.5	5	10.7	12.5
15%.....	2.65	0	0	0	0	0	0	10.0
100%.....	3.68	13	15	2.1	3.1	5.2	11.2	70.7

(All calculations carried to nearest 0.1)
Specific gravity galena—7.5
Specific gravity sphalerite—4.0
Specific gravity pyrite—5.0
Specific gravity quartzite—2.65

Table 2.

Results of Test Floating Reground Material Separately Shows High Recovery In Fine Sizes.

Mesh	Regrind Flotation Tails	
	Assay % Pb	% Distribution
+ 65.....	0.30	5.63
+100.....	0.33	19.90
+150.....	0.28	15.89
+200.....	0.27	17.16
+325.....	0.16	13.61
—325.....	0.17	27.81
	0.22	100.00

Table 3.

Before Using Flash Grind.

Flotation Tails—Screen Analysis

Mesh	%	Lead Assay	Lead Content	Lead % Total	Zinc Assay	Zinc Content	Zinc % Total
+ 48	0.0	0.00	0.00000	0.00	0.00	0.0000	0.00
+ 65	4.8	0.73	0.03504	4.36	1.05	0.0504	6.45
+100	7.8	0.51	0.03978	4.94	1.12	0.0874	11.19
+200	25.4	0.55	0.13970	17.36	0.92	0.2337	29.91
+325	14.6	0.47	0.06862	8.53	0.47	0.0686	8.78
—325	47.4	1.10	0.52140	64.81	0.72	0.3413	43.67
Total	100.0	0.80	0.80454	100.00	0.78	0.7814	100.00

Table 4.

After Using Flash Grind.

Flotation Tails—Screen Analysis

Mesh	%	Lead Assay	Lead Content	Lead % Total	Zinc Assay	Zinc Content	Zinc % Total
+ 48	3.2	0.40	0.0013	0.30	0.30	0.0010	0.30
+ 65	5.6	0.53	0.0030	0.69	0.60	0.0034	1.02
+100	11.2	0.58	0.0650	14.95	0.70	0.0784	23.54
+200	20.4	0.35	0.0714	16.42	0.35	0.0714	21.44
+325	14.2	0.28	0.0398	9.16	0.30	0.0426	12.79
—325	45.4	0.56	0.2542	58.48	0.30	0.1362	40.91
Total	100.0	0.43	0.4347	100.00	0.33	0.3330	100.00

In any group of particles forming what is termed an ore, there are various fractions based on specific gravity and other characteristics. Even individual particles themselves may be composites of various fractions.

Ore Composition

To illustrate, a piece of ore 1 in. in size may have the following characteristics: 15% of the weight being massive, relatively high-grade galena assaying 60% lead, 5% zinc, 5% iron, 12.5% insoluble. Perhaps 50% of the weight may be finely disseminated, containing 1% lead, 1% zinc, 6% iron, 84.5% insoluble. Also, 15% of the weight may be disseminated containing 3% lead, 4% zinc, 8% iron, 73.4% insoluble. Then 5% of the weight may be very thin high-grade streaks of galena, traversing the total volume, assaying 60% lead, 5% zinc, 5% iron, 12.5% insoluble. Last 15% of the weight being barren quartzite, through which the high-grade streaks mentioned previously traverse. Specific gravity of each of the components of such ore particles, as well as the average specific gravity and assay value, are given in Table 1.

The part of the ore with specific gravity 3.03, assaying 1% lead, 1% zinc, etc., requires the finest grind. It should be ground to 60% minus 325 mesh. To do this in the usual grinding circuit, at least 35% of the ore will be subjected to grinding beyond requirement.

However, grinding the highest specific gravity portion (constitutes 20% of the total) to the mesh it requires for liberation will mean that none of the other fractions is ground to its needed limits.

No One Best Grind

Optimum metallurgy for all the fractions cannot be obtained by operating under conditions to give optimum results on any one fraction. Nor can optimum recovery be had on all fractions by attempting to strike an average.

When the plant is so operated as to reduce the disseminated fraction containing 1% lead and 1% zinc to optimum size, all ore fractions beyond that are subject to varying degrees of overgrinding. This consumes power, steel, and reagents excessively, and particularly reflects in high tailing losses.

By reversing the primary grind so as to grind the high-grade fraction to optimum size, no overgrinding occurs. Instead, the successive fractions are retained at sizes that are not finished but require additional grinding for complete mineral liberation. The material remaining and requiring additional grinding is considerably more homogenous as regards to size, specific gravity, hardness, etc. It is, therefore, relatively uniform as to grinding and classification behavior.

It was established that each ore fraction requires a particular grind to liberate mineral particles most effectively and efficiently in that fraction. In general, it can be said that the fraction having the lowest specific gravity also has the greatest hardness, greatest mineral dissemination, and finest particle size.

Conversely, the ore fraction possessing the highest specific gravity also has the least hardness, the least mineral dissemination, and the largest mineral particle size. Therefore, we have established the procedure of a superficial or flash grind in the primary grinding circuit.

Thick Overflow

We carry 80% solids in the ball mill, 54% solids in the classifier overflow, giving a screen analysis of about 17.8% plus 65 mesh, 29.6% plus 100 mesh, 47.1% plus 200 mesh, 59.3% plus 325 mesh, and 40.7% minus 325 mesh.

When the coarse primary grind

WATCHING THE DENSITY of the classifier overflow in the Bunker Hill mill is Dave Chantry's job. Holding it at 54% solids makes . . .

AN EASIER JOB for Homer White, flotation operator, here adjusting air on a lead cell. The coarse primary grind helps both men.

was first established, flotation of both lead and zinc followed the primary grind. The zinc rougher tailings were then classified, the slime fractions being rejected as tailing, and the sand fraction reground and returned to the lead rougher circuit. A portion of the lead rougher concentrate and a portion of the zinc rougher concentrate were also reground and retreated by flotation in this circuit.

Flotation Control

The main flotation circuits were so controlled as to put into these two products a particular fraction of the ore. The purpose of this procedure was to keep all the ore particles in the pulp stream at a size at which they are controllable as regards to classification and flotation, and to segregate them so as to be regrinding and classifying particles in the same specific gravity and hardness range. It was intended that the assay values of the coarse sizes in the tailing prior to classification and regrinding would be high.

The final objective was to grind and classify each rock particle to the size required for optimum metallurgy. During the test periods about 1,340 tons per day of zinc rougher tailings were handled by the regrind cone. Of the 1,340 tons, some 300 tons reported to the regrind ball mill for further grinding, and the remainder was discarded as final tailings.

Current practice is to classify, regrind, and refloat the lead rougher tailings rather than the zinc rougher tailings. With this flowsheet, the cone overflow and Esperanza classifier overflow make up the zinc rougher feed. The zinc rougher tailings are the final tailings.

This change has not lowered the final tailing assay as against the original regrind practice, but has reduced the amount of lead reporting in the final zinc concentrate. A comparison of the final flotation tailings prior to regrind practice and after the establishment of the regrind practice is shown in Tables 3 and 4.

The regrind practice is done in a regrind circuit as shown in the accompanying flowsheet. It consists of an 8-ft. cone, Esperanza-type drag for dewatering and classification, and an 8-ft. by 36-in. Hardinge conical ball mill and a 6x20-ft. Dorr model "D" duplex classifier. Flotation of the reground material has been done in a separate circuit consisting of four 36-in. Agitair flotation machines to obtain positive evidence of the amount of mineral recovered and to determine the kind of product that can be produced from this material. Table 2 shows an analysis of the tailing from the regrind flotation circuit.

Tailing Not Tailing

Mineral losses, which were considered difficult of recovery due to the size fraction in which they were occurring, by changed operating conditions have been placed in a fraction from which subsequent treatment does not recover the mineral at an economic gain. **It was concluded that any fraction of what has been or is being called a tailing does not rightly deserve that name if the mineral or a portion of the mineral in that fraction can be recovered profitably.**

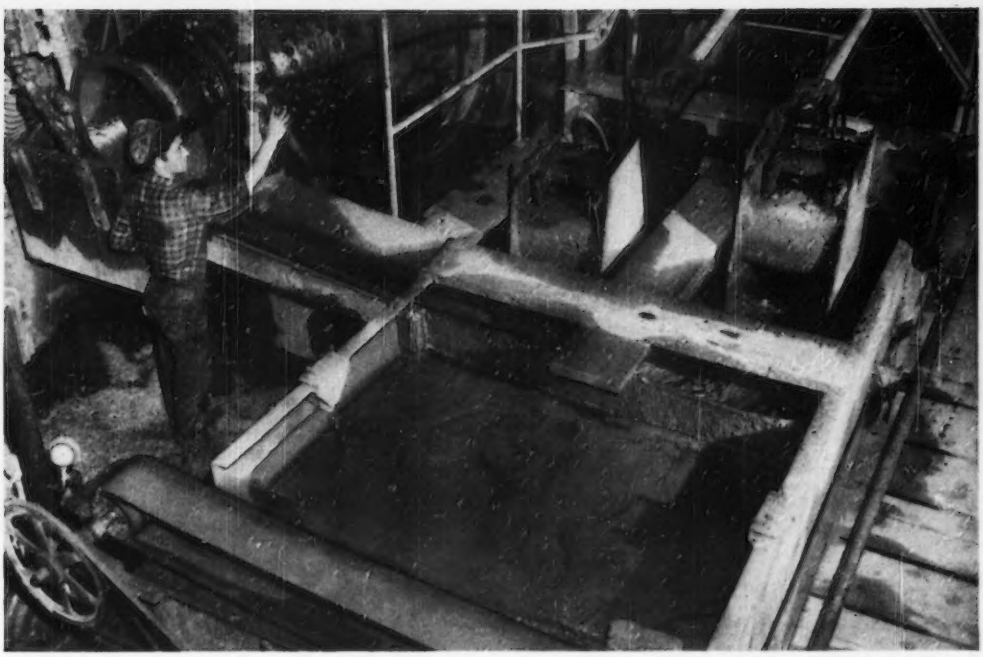
Under current practice, the following gains have been made:

1. Overgrinding has been reduced.
2. Recovery of lead and zinc has been increased.
3. Average grade of lead concentrate has remained nearly the same, and the grade of the zinc concentrate has been improved. A greater percentage of the lead reports in the lead concentrate, and a greater percentage of the zinc reports in the zinc concentrate.
4. Grinding circuit capacity has been increased.
5. Water consumption has been reduced.
6. Pulp tonnages handled have been reduced.
7. Flotation pulp density is greater.
8. Reagent consumption has been reduced.

Expansion Program

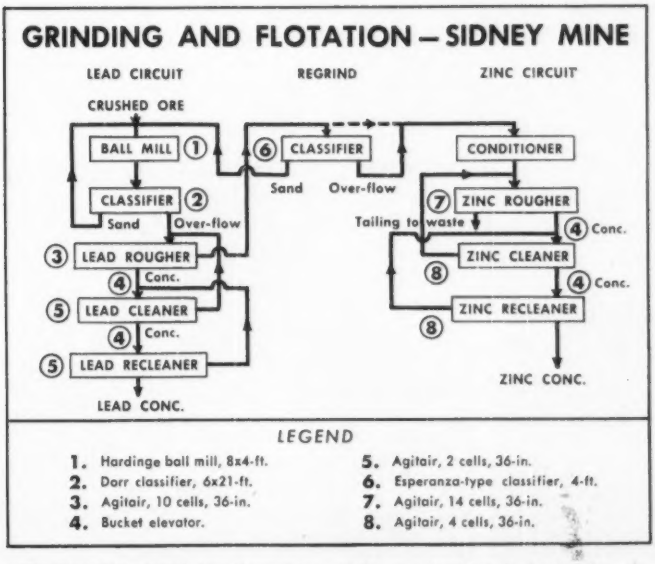
Development of the flash grind technique is a part of Bunker Hill's new construction and equipment program, which has been carried on for the past two years. Its aim has been to increase mill capacity from 1,800 tons a day to 3,200 tons. Several small units in the mill were replaced, and an entire new building was erected.

In conclusion, I wish to express my thanks to J. B. Haffner, vice president and general manager, Bunker Hill & Sullivan Mining and Concentrating Co., and C. Y. Garber, mill superintendent, for permission to publish this article. Grateful acknowledgment is also made to Robert E. Laskey and Archie McDonell, of the mill staff, for their invaluable assistance in carrying out the experimental work and collecting data covering current grinding practice.



THIS CLASSIFIER OVERFLOWS at 45 to 50% solids to get coarse grind in Sidney mill, Pine Creek neighbor of Bunker Hill, where Archie McKinley, Frank's brother, is mill superintendent. In this picture, Leo McLeod cuts off make-up water; the pulp's too thin.

The Sidney Uses the Flash Grind, Too



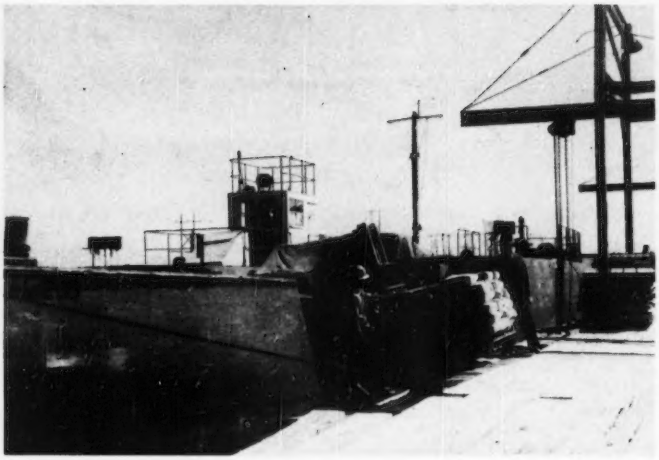
WITH THIS FLOWSHEET, the Sidney gets much the same benefit as Bunker Hill from the flash grind. Mineral liberated is recovered at once. Locked mineral returns to ball mill.

THE SIDNEY MINE, in the Pine Creek district near Kellogg, uses the grinding technique outlined in the foregoing article and with equally good results. At present, as the flowsheet shows, an extra ball mill for regrinding the lead rougher sand fraction is not available, but the staff hopes to put one in before long.

The idea is the same as at Bunker Hill. The high grade rides through the ball mill and classifier on a thick pulp, and the free mineral is floated out of it. Sands that need more grinding are sent back to the mill. These are the results at Sidney:

1. Grade of lead concentrate has been improved slightly.
2. Grade of zinc concentrate is up about 1%.
3. Recovery of lead in lead concentrate up about 5%.
4. Recovery of zinc in zinc concentrate up about 2%.
5. Economic extraction of lead and zinc combined up about 3.5%.
6. Plant tonnage increased about 5%.

WATER-BOUND sulphur mine has to solve a special supply problem.



CONVERTED LANDING CRAFT purchased from war surplus give better service than towed barges in bringing supplies from Harvey warehouse and Port Sulphur.

13 Ways A Sulphur Producer Cut

A. A. GUSTAFSON
Operations Assistant to the General Superintendent
Freeport Sulphur Co.
Port Sulphur, La.

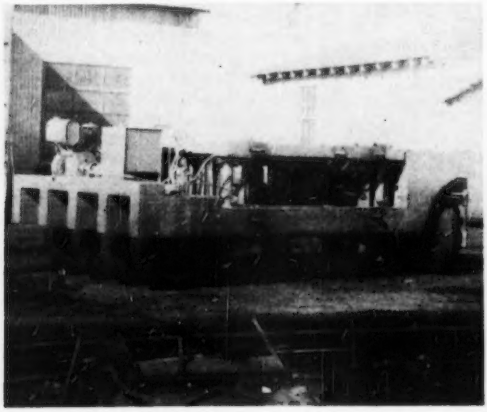
BY A CAREFUL STUDY of practices which neither produced nor improved the product, Freeport Sulphur Co. in the past few years has been able to markedly reduce costs at its Grande Ecaille, La., property, in handling of equipment, supplies or product.

1. Converted landing craft provide economical supply service.

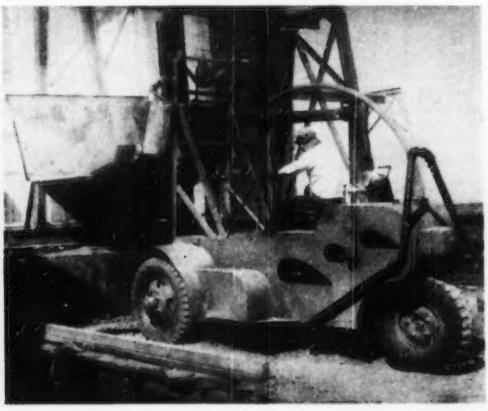
Widespread warehouse facilities (see map above) connected only by water transportation required a dependable and economical means of keeping supplies flowing in to the property. Barge tows, first used, were too slow and inflexible.

Ex-navy engineers on the staff suggested LCT, landing craft used during the war. Two LCTs, purchased for transportation of supplies, were modified to facilitate loading and unloading. The three-motored, diesel-powered craft have proved efficient and dependable, permitting a regular scheduled transportation service between warehouses and the mine.

Loads run about 200 tons per trip. Fork trucks can easily run on and off to handle pallet loads. There are no obstructions to hinder use of crane for loading and unloading pipe and lumber.



HYDRAULIC LIFT will move drilling machinery from one derrick to another. Old practice called for blocking up tractor wagon.



SCOOPMOBILE is operated on three shifts for reclaiming waste sulphur. Manual labor costs were formerly prohibitive.

Comparative Cost on Bagged and Miscellaneous Materials

Man Hours	Machine	Rate	Unload Cars & Load Freight Boat	Unload Freight Boat Haul & Stack	Total
8		$1.40	$11.20		
4	Lift truck	2.00	8.00		
8	Lift truck	2.00		$ 16.00	
20			$19.20	$ 16.00	$ 35.20
	Handle 40 tons. Cost per ton by lift trucks.				**$ .88**
24		$1.40	$33.60		
36		1.40		$ 50.40	
4	Tractor & wagon	2.00		8.00	
64			$33.60	$ 58.40	$ 92.00
	Handling cost 40 tons by old method (per ton)				**$ 2.30**
	Saving per ton				**$ 1.42**

If bagged material had to be stored before using, handling cost by new method would show additional savings.

Rate for machinery includes operator.

Comparative Cost of Handling Lumber

Man Hours	Machine	Rate	Unload Cars & Load Barges	Unload Barges & Haul to Job	Total
4	Large crane	$4.50	$18.00		
16		1.40	22.40		
8	Small crane	3.50		$ 28.00	
32		1.40		44.80	
8	Straddle truck	2.50		20.00	
68			$40.40	$ 92.80	$133.20
	Cost to handle car of lumber, 20,000 bd. ft., 50 tons—by cranes and straddle trucks (per ton)				**$ 2.66**
56		$1.40	$78.40		
8	Tractor & wagon	2.75		$ 22.00	
72		1.40		100.80	
136			$78.40	$122.80	$201.20
	Cost to handle car of lumber, 20,000 bd. ft., 50 tons—by old methods (per ton)				**$ 4.02**
	Saving per ton				**$ 1.36**

If lumber had to be stored before using, handling cost by new method would show additional savings.

Rate for machinery includes operator.

Costs And Improved Handling

2. Lift trucks and pallets save $1.42 per ton load.

Freeport has five lift trucks ranging from 1-3 tons capacity. These are used at Harvey for unloading box cars and trucks and loading the LCT freight boats. Lift trucks go up a portable ramp and into the box cars with their pallets where lime, soda ash, and other chemicals for treating 6,000,000 gallons of water per day, and filtering sulphur, are unloaded from the cars and loaded onto the freight boats at the rate of a car every 4 hours by a three-man crew.

At Grande Ecaille most supplies are unloaded with lift trucks at four different docks, and the bagged materials are stacked at the various points of storage. Only part time is required for a seven-man crew. The pallets used are 48x54 in. with an overhang of about four inches on the sides. This enables the straddle trucks to pick up the same pallets, two at a load, and deliver drilling mud and cement to the well locations without rehandling loads. The overhang also permits handling by cranes with slings when necessary. Pallet loads of chemicals, filter materials, mud and cement are handled in about 3,000-lb. unit loads.

Formerly, this work was all done by hand and required large labor crews. The saving is $1.42 per ton. Comparative costs are shown in detail above.

At Grande Ecaille the mining area was originally partly boggy marsh and partly lake. Before mining could be started this area had to be filled, and after a few years, subsidence took place as sulphur was mined. One area subsided from 6 ft. above sea level to 17 ft. below sea level. This required construction of a levee to fill the mining area again to 6 ft. above sea level. Therefore, the present mining area is a 500-acre island surrounded by an 8-ft. levee. As half of this island is being mined, the other half is being filled by two large suction dredges operating several miles away.

To support the heavy equipment which is used in sulphur mining timber is used for roadways at an installed cost of about $10 per running foot. At present there are 30,000 ft. of timbered roadways in use. As drilling and producing wells are constantly moving to new locations, the roads, or ramps, are being moved also.

3. Straddle trucks save $1.36 per ton of load carried.

We have 1,000,000 ft. of new lumber shipped in each year for building roadways in the mining area, and reclaim and re-use an equal amount. Handling by straddle trucks has proved a complete success even on our narrow board roadway. The fleet now consists of four 12,000-lb. capacity trucks. In addition to handling packages of lumber, about half of their time is consumed in hauling pipe for new sulphur wells and disposing of used pipe. Cement, machinery, drilling mud, tools, and other materials are also handled by straddle trucks. Attached table shows savings over old hand methods.

Pipe was formerly rolled off of a barge and then up to the bed of an Athey wagon, and handled the same way from pipe racks. Now even 40-ft. lengths of 10-in. pipe are handled in unit loads by the straddle trucks.

4. Rubber-tired cranes cut costs on many jobs.

Two rubber-tired cranes with 30-ft. booms are widely useful because of their speed and maneuverability on the narrow ramps.

They can be used for servicing wells where formerly the drilling crew had to take time to string up a traveling block in the derrick.

They have salvaged lumber that was formerly impossible to salvage.

The cranes aid in laying heavy surface sulphur and water lines.

5. Hydraulic lift table saves time in moving drilling machinery.

Drilling machinery was moved by tractors, but first a ramp of square timber had to be built for the

Athey wagons so that the bed of the Athey wagon just came flush with the derrick floor on which the machinery rests. Recently a hydraulic table mounted on a rubber tired carrier was purchased. This eliminates the necessity of building a ramp to move the drilling machinery. This 13-ton drawworks is now skidded onto the hydraulic table by tractors, table lowered and equipment moved to next location much faster than by the old method.

6. Unit well head equipment drastically reduces time required for well connections.

A sulphur well consists of a series of concentric pipes. Typically, an 8-in. pipe delivers hot water into the rock formation to melt the sulphur. A 4-in. line conducts the liquid sulphur lifted to the surface by means of compressed air, injected through a 1¼-in. pipe. Connections between these pipes and surface lines are complicated by expansion and contraction considerations, valves needed for controlling well production, and a separator for removing air from the sulphur.

In former practice piping varied from well to well. Now practically all of the well-head piping is standardized on a skid-mounted frame work. A tractor can easily drag it on the board ramps from one location to another. Crew's time for making well-head connections has been reduced from a matter of days to a few hours.

7. Portable gathering stations can be moved instead of scrapped.

Sulphur gathering stations receive and meter the molten sulphur from each well and pump the sulphur to treating plants and stockpiles. Volume of air and water going to each well is metered here. The structure also houses separators which remove any air and gas not removed at the well head. Most recent station built to handle half the 3,000-ton per day production was built in sections, mounted on skids, so that it is semi-portable.

Formerly these relay stations were built without any thought of moving them, but with rapid subsidence came the necessity of building new stations every few years. We reduced this expense by designing a sectionalized structure with each section mounted on heavy welded pipe skids. Practically all the cost of dismantling and erection will be saved when these portable gathering stations are moved.

8. Scoopmobile saves $2.00 per ton of scrap sulphur reclaimed.

In bringing a sulphur well into production, the sulphur first returned is apt to foul the collecting tanks at the gathering station. To prevent this it is disposed of in a pile near the gathering station. When a sufficiently large pile accumulates it is sent to the filter plant to be melted and filtered.

Original method of handling this sulphur was to load into dump trucks by dragline, then load barges by dragline as trucks dumped the sulphur on one of the docks. After towing the barges to the filter plant they were again unloaded by draglines into trucks which dumped into storage. A three-wheeled half-ton capacity scoopmobile dug and transported sulphur to melter.

Two dragline handlings are now eliminated by arranging for trucks to dump directly on barges and having scoopmobile move sulphur direct from barges to melter over a lift span. This change reduced handling costs over $2.00 per ton.

At one time walls for the sulphur bins were built of 2-in. plank, and the molten sulphur was distributed in the bin by means of overhead pipe lines furnishing feed to a hand-operated distributing system. When needed for shipment, the solidified sulphur was drilled, blasted and loaded out with 1¾-yd. shovels. The shovels dumped into a hopper equipped with a grid and two men broke the large lumps with picks. A pan feeder fed the broken sulphur to a 240-ft. portable 36-in. conveyor, which in turn fed a trunk line conveyor that dumped its load onto 500-ton wooden canal barges. Two such portable conveyors fed the trunk line belt, one operating on each side of the belt.

9. Elimination of blasting saves 2c. per ton of sulphur.

Sulphur is no longer blasted but is dug out of a solid bank by a 2½-yd. shovel. Digging and loading rate is approximately the same in tons per shift without blasting as with blasting. Elimination of blasting has removed the consumer's big headache—unexploded dynamite caps or powder in the sulphur—and at the same time saves about 2c. per ton.

10. Crusher and portable hopper save $20,000 per year in wages.

Sulphur is now loaded into a portable hopper which is mounted on a portable conveyor. Men for breaking lumps are no longer required, as a Freeport-designed crusher breaks large lumps to conveyor size. With shipments of one million tons per year, mechanization here represents a saving of about $20,000 per year at present wage scales.

11. Payloader may save $5,000 per year.

Operation of a track-mounted tractor and bulldozer in the sulphur has been a source of costly repair several times a year due to the rapid corrosion of treads and pins. Small rubber-tired equipment has been available, but the only rubber-tired equipment of bulldozer size on the market was too large and costly for our operation. Recently a rubber-tired machine, called a "Payloader," replaced a bulldozing track-equipped tractor, and we anticipate a saving of $5,000 a year for repairs. In addition to doing the necessary bulldozing the machine can also dig and stack material to an 8-ft. height.

12. Wheels on cross conveyors and hinged hopper heads save time for loading crews.

Cross conveyors were shortened to 180 ft. Three-feet wide wheels are spaced at intervals along the length of the belt so that it can easily advance with the loading shovel.

Cumbersome hopper heads over the main conveyor belt, which formerly had to be removed when cross conveyors had to pass each other, have been hinged. Now passing is a matter of minutes for the loading crew.

13. Ship trimming spout saves $400-$800 per ship loaded.

At Port Sulphur sulphur from Grande Ecaille is temporarily stored in bins. It can then be loaded either in ships on the Mississippi River or in box cars on the railroad running along the levee.

In loading a ship, the cargo must be trimmed to keep the ship on an even keel. It is also necessary to trim to get all the cargo aboard ship because few bulk cargoes will fill the ship's holds by merely dumping through the hatch. Cost of trimming has been practically eliminated by installation of a device first designed by Freeport engineers.

The old method of trimming was to drag the sulphur to the sides of the hold with scrapers similar to underground scrapers at a cost of $400-$800 per ship. Most of this cost has now been saved by installation of a stiff spout, sectionalized near bottom for length adjustment, and equipped at the end with what we call a trimming head. This trimming head is so designed that it throws the stream of sulphur about 30 ft. The gearing and motor for operating this spout is mounted on a boom conveyor which must be raised and lowered each time the vessel is shifted.

Strong Dosage Is Remedy In Gold Recovery Problem

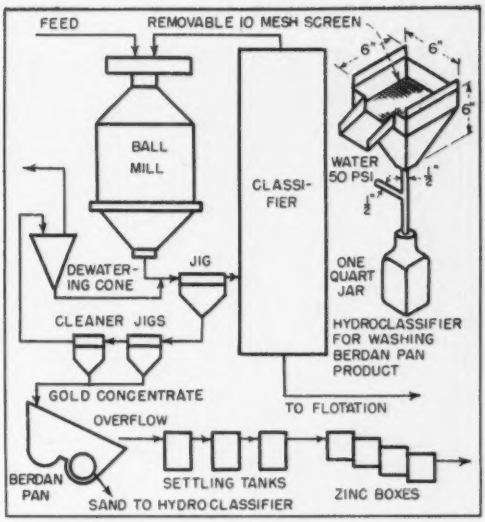
Here is the mixture Resurrection uses to get clean amalgamation of rusty gold in a heavy sulphide concentrate without floured quick.

A 30-in. Berdan pan is charged with:

Sulphide concentrate	50.00 lb.
Sodium hydroxide	0.75 lb.
Sodium cyanide	0.50 lb.
Lead acetate	0.50 lb.
Quicksilver	10.00 lb.
Hot water	2 gal.

and ground for two hours. Amalgamation is then complete.

KEITH KUNZE, Mill Foreman
Resurrection Mining Co., Leadville, Colo.



COARSE GOLD shows up frequently in the ore being milled by the Resurrection Mining Co., Leadville, Colo. Handling it presented a problem, and from the time the mill started in 1942, frequent attempts were made to improve gold recovery because:

1. Gold loss in the tailing was higher than it should be.

2. Gold was dissolved by the cyanide used in the lead flotation circuit as a zinc depressant.

3. The lead concentrate was hard to sample accurately for gold because of the irregular appearance of coarse gold.

4. Production of bullion would be more profitable.

The Resurrection mill treats a complex heavy sulphide gold-silver-lead-zinc-iron ore by flotation. Testwork indicated finally that a jig in the ball mill circuit would recover a concentrate from which the bulk of the gold could be recovered by amalgamation.

Actually, the flowsheet shown on this page now recovers 40 to 55% of the gold in the mill feed as amalgam. The job was by no means easy however, because the heavy sulphide concentrate and the tarnished nature of the gold particles made amalgamation a problem. All of the standard remedies were tried, but gold recovery was low and the quicksilver "floured" excessively. Microscopic examination of the gold particles showed them to be coated with galena and limonite.

Using the mixture shown above, our present practice recovers over 98% of the gold in the concentrate, as amalgam, in two hours of treatment. There is no difficulty with floured mercury. This process has run successfully for nearly three years.

Running the Jigs—The jig circuit has to be run to suit the amalgamation step. This means that 40 to 55% of the gold in the 400 tons of ore milled daily has to be collected in a product weighing about 50 lb. This 16,000 to 1 concentration is done in a rougher jig followed by two cleaners.

The rougher jig is a 30-in. Pan American, run on a 5/8-in. stroke at 120 strokes per minute. A 5/32-in. woven wire screen supports a 2-in. bed of 3/16-in. steel shot. Total jig bed depth is 6 in. Hutch water pressure is 15 lb. This jig produces about 4 tons of hutch product daily.

Surprisingly, gold recovery with this jig decreases if more hutch product is pulled, which is in complete contrast to normal gold jig operation. The explanation seems to be that pulling more hutch product unbalances a critical shot-to-bedding ratio and causes channeling through portions of the jig bed.

We have therefore found it most important to disturb the galena and pyrite bedding as little as possible. This bed takes several weeks to build properly, and the jig bed is scraped very carefully.

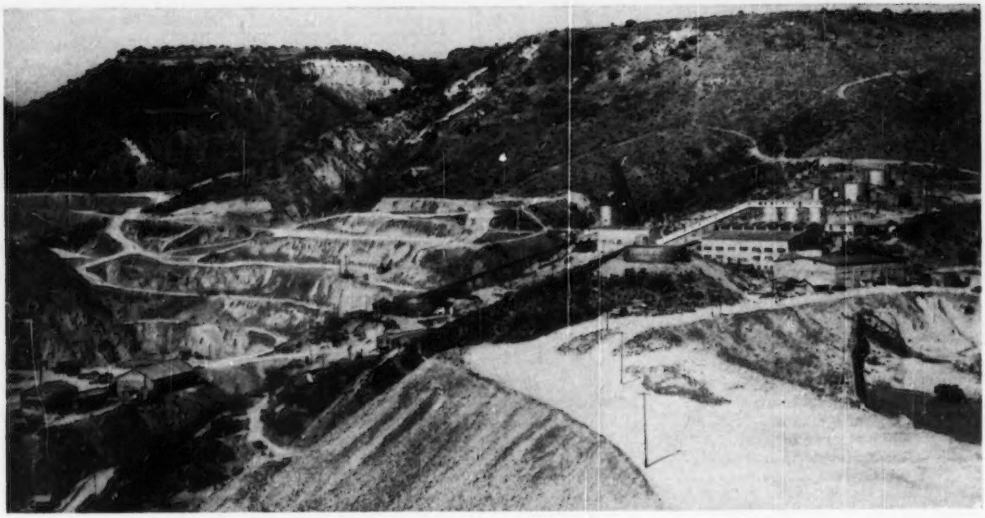
A bucket elevator discharges the rougher concentrate over two 12-in. Pan American jigs in series. These run at 360 to 420 strokes per minute on a 3/8-in. stroke. A 1½-in. bed of 3/16-in. shot supports a 3-in. heavy sulphide bed. The hutch product is caught in buckets and amalgamated daily. The cleaner jigs are even more dependent on proper bed conditions than the rougher jigs.

Amalgamation Succeeds—The jig concentrate is ground for two hours in a 30-in. Berdan pan with the mixture shown above. Overflow runs through settling tanks and over zinc shavings to pick up any gold that may have been dissolved by the cyanide.

The amalgam is then recovered by washing the contents of the Berdan pan out over a hydro-classifier (shown in sketch). Final cleaning is done in an amalgamating gold pan.

Success of the amalgamation procedure depends on the concentration of the three reagents used. Before we discovered this, we tried: roasting, acid pre-washing, very fine grinding, oxidizing grinds with potassium dichromate, pre-washing grinds with normal amounts of lime, soda ash, sodium hydroxide, lead acetate, cyanide, sodium chloride, sodium amalgam, etc., and various combinations of the foregoing.

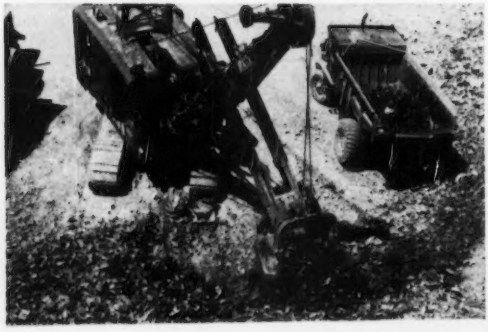
Only the procedure we now use was successful in not only cleaning the gold rapidly, but also in preventing floured mercury. Our mercury loss now does not exceed 4 lb. per month.



BAGDAD COPPER CORPORATION'S production now comes solely from its new open-pit mine at Bagdad, in Yavapai County, Arizona. Underground operations from shaft seen in picture are no longer contemplated. Concentrator, at right, is treating monthly 100,000 tons of ore containing approximately 1% copper. Employees total 275. E. R. Dickie is general manager of the enterprise.

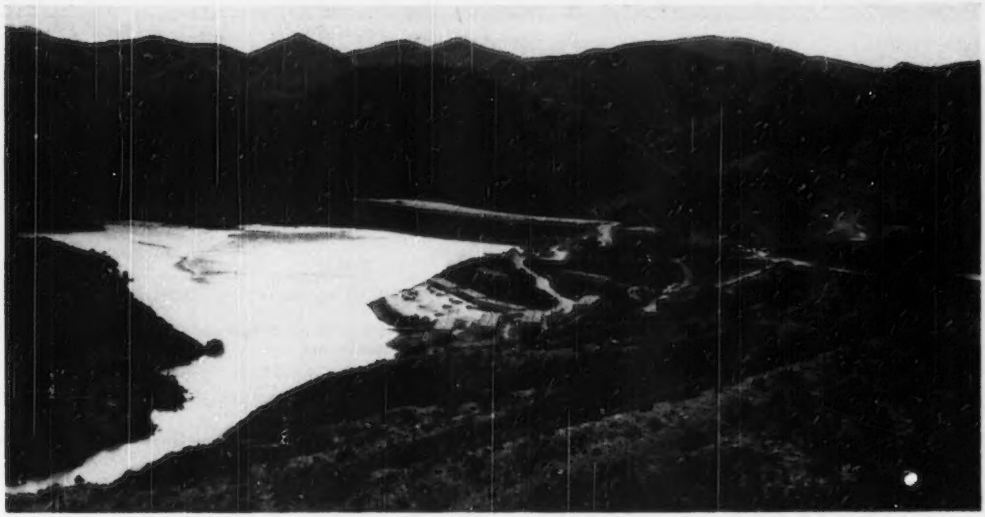
Bagdad Yields Bigger Tonnage as

More flexible mining, as compared with operations, provides ample ore supply



CLOSE-UP of operation of loading the waste stripped. Material is stored on dumps for future leaching. Pit grades run up to 14%.

STRIPPING OF WASTE is done with two P.&H. shovels, one of them 4½-cu.yd. electric and one 3-cu.yd. diesel-driven. It is progressing at a rate of 125,000 tons per month. Transport is supplied by two 30-cu.yd. Tournarockers and 11 Euclid trucks ranging from 10 to 16.8-cu.yd. capacity. Blastholes in waste are put down by two Bucyrus-Erie 27-T churn drills.



TOWNSITE and tailings pond of concentrator at Bagdad. Ample space is available here for the disposal of the mill waste in the future.

The mill building and the open pit shown in the accompanying pictures on this and the opposite page are over the hill at the right.

Open Pit

the former underground for concentrator

IN CLEAN-UP WORK, as well as in loading, shovels are assisted by three bulldozers, including this rubber-tired Tournadozer and two Caterpillar units. There are also a ¾-cu.yd. Bucyrus-Erie shovel, a Galion road grader, and a service truck.

MINING, as well as stripping, is done in 50-ft. benches. Blast holes 7 in. in diameter are drilled to a point 5 ft. below bench and are spaced 12 to 15 ft. for ore and 15 to 20 ft. for waste. They are loaded with 10% and 65% powder in bags and are fired with two lines of Primacord. Broken ore is dug with 2½-cu.yd. Northwest diesel shovel, shown in this photograph, and is taken to the pit crusher in five Euclid trucks. A 22-T churn drill is used for putting down blast holes in ore.

TABLE I.—Comparison of Methods on Solutions High in Gold and Copper

Test No.	Method Used	Mg. Au Obtained	Remarks
1	Chiddey	18.72	no sponge—soln. filtered very slowly
2	Litharge-evaporation	19.01	24 hr. evap. and fusion
3	Lead-acid	18.21	not filtered—bits of Cu floated off in decanting
4	Lead-acid	18.02	not filtered—bits of Cu floated off in decanting

SOLUTION: 1,200 g. ore carrying 5.56 oz./ton Au and 2% Cu agitated for 24 hrs. in solution of 3.6 g. NaCN, 6.0 g. CaO in 2,400 g. water.
SIZE SAMPLE USED: 200 ml. (7 A.T.)

TABLE II—Comparison of Methods on Pure Silver Solution

Test No.	Method Used	Ag Added, mg.	Ag Obtained, mg.	Loss %
1	Lead boat	5	4.6	8
2	Chiddey	10	9.4	6
3	Lead-acid	10	9.5	5
4	Lead-acid	10	9.5	5

SOLUTION: .05 mg. Ag/ml.; 1 g. CaO/2 liters; 1 g. NaCN/2 liters.
SAMPLE USED: 200 ml. in lead-acid and Chiddey methods; 100 ml. in lead boat method.

A Better Way To Assay Cyanide Mill Solutions

As any cyanide metallurgist knows, there is no completely satisfactory method for assaying cyanide mill solutions. Here is a report on a new method, using test lead and hydrochloric acid, that takes only 20 minutes, increases accuracy, and uses lower cost materials

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THE ORDINARY ROUTINE of cyanide plant control requires a rapid, accurate method of assaying cyanide solutions, both rich and barren, for their silver and gold content. The lead-acid method, described in this article, is suggested as meeting that requirement.

Among the techniques of cyanide solution assay now in use, the lead boat[1] evaporation method is most common. It is applicable only to fairly rich solutions and is open to error through leakage of the lead foil "boat." For barren solutions, the Chiddey[1] method is in general use, but it is unsatisfactory for solutions high in copper. The alternate litharge evaporation method, if done accurately, is quite time-consuming. Other methods[2] also use a number of solutions or take several hours to complete the assay.

The lead-acid method, described here, is rapid and accurate. It uses no expensive reagents or apparatus, and is even simpler in principle and application than the Chiddey method. It may be used over a wide range of solution values or contaminations.

The sample of mill solution is made strongly acid with HCl and boiled with granulated test lead. Gold and silver ions are displaced from the solution by the lead, and the agitation produced by boiling brings every precious metal ion into contact with the lead.

Recommended Procedure

Use from 5 to 17 A.T. of solution, depending on value. For a solution carrying about $4 per ton, 7 A.T. is a convenient amount. Heat sample in a 600-ml. beaker until nearly boiling. Add 8g. (about half a hornspoonful) of granulated test lead, sprinkled evenly over bottom of beaker.

Acidify with 10 ml. strong HCl, cover with watch glass, boil strongly 10 to 15 minutes. Caution: acid must be added, and sample boiled, under a hood because poisonous HCN gas is given off as soon as the sample is acidified.

Cool solution and decant carefully into sink or through fast filter, such as Whatman No. 4. Wash lead twice by decantation and dry on hot plate. Take no more than 5 min. to dry lead.

Brush dry lead cake out of beaker into lead foil. Wrap carefully. If filter was used, wrap paper along with lead cake. Cupel in ordinary way.

If filter paper is to be cupeled wet, the lead foil must be ventilated by punching holes in it. Drying before cupellation is preferable.

Testing the Method

All test work in developing the lead-acid method was carried out with standard equipment and chemicals. The Chiddey and the litharge-evaporation tests, run for comparison purposes, were made on 200-ml. samples using the techniques outlined in the references cited.

Essentially the lead-acid method consists of boiling the sample with lead in an acid solution. The variables are: the amount of lead, the

[1]Shepard and Dietrich, *Fire Assaying*, pp. 136-197. McGraw-Hill, N. Y., 1940.
[2]King and Wolfe, *An Improved Cuprous Chloride Method for Assay of Gold in Cyanide Solutions*. Canadian Mining Journal, January, 1938.

TABLE III.—Comparison of Methods on Impure Silver Solution

Test No.	Method Used	Ag Added, mg.	Ag Obtained, mg.	Loss %
1	Lead boat	5	4.7	6
2	Chiddey	10	9.4	6
3	Lead-acid	10	9.6	4
4	Lead-acid	10	9.7	3

SOLUTION: Same as Table II plus 1g. $CuSO_4$/liter.
SAMPLE SIZES: Same as Table II.

TABLE IV.—Comparison of Methods on Pure Gold Solution

No. Test	Used Method	Added, mg. Au	Obtained, mg. Au	% Loss
1	Chiddey	2	1.84	8
2	PbO-evap.	1	0.99	1
3	Lead-acid	2	1.95	2.5
4	Lead-acid	2	1.95	2.5

SOLUTION: 16.09 mg Au; 2.4 g. NaCN; 4 g. CaO; 1,600 ml H_2O agitated in bottle for 24 hrs.

TABLE V.—Comparison of Methods on Barren Solution

Test No.	Method Used	Au Obtained, mg.	Remarks
1	Chiddey	0.04 0.05	Good sponge
2	Lead-acid	0.06 0.07	½ hornspoon Pb—15 ml. acid—15 min. boiling
3	Lead-acid	0.06 0.07	¾ hornspoon Pb—25 ml. acid—20 min. boiling

SOLUTION: $95/ton soln. diluted to approx. $0.15/ton; NaCN-CaO strength brought up to 1 lb./ton each.
AMOUNT USED: 500 ml. sample.

TABLE VI—Comparison of Methods on Pregnant Solution

Test No.	Method Used	Au Obtained, mg.	Remarks
1	Lead boat	0.43 0.41	100 ml. sample used
2	Chiddey	0.82 0.75	Good sponge
3	Lead-acid	0.92 0.93	

SOLUTION: $95/ton soln. diluted to approx. $4/ton; NaCN-CaO strength brought up to 1 lb./ton.
AMOUNT USED: 200 ml. sample.

amount of acid, the length of boiling time. The inherent simplicity of the method lies in the fact that each of these variables has a wide range of values over which precious metal recovery remains practically constant.

Varying the amount of HCl between 5 ml. and 60 ml. showed little change in metal recovery. Varying lead addition between 5 g. and 15 g. showed no change in recovery beyond that attributable to cupellation loss. Boiling time seems to be the most sensitive variable. Recovery improves only slightly as boiling time increases from 5 to 15 min., but it is essential that the solution be boiled at least 2 min.

Because silver lies above gold in the EMF series, it seemed logical to assume that silver should be the more difficult of the two to precipitate out of solution. Therefore, most of the preliminary work was done using a silver solution made up with $AgNO_3$ and NaCN.

As soon as the effect of the several variables was determined, the method was applied to solutions obtained from agitation tests on actual ores. In order that the tests should represent the most refractory conditions found in practice, ores containing considerable malachite and azurite were cyanided. The resulting solutions, high in gold and copper, were used to compare the Chiddey, the litharge-evaporation, and the lead-acid methods of assay. Results appear in Table I.

Handling Copper

In these tests much copper precipitated out on the test lead, and it is believed that some gold was lost with bits of copper that floated off during decantation. If the solution had been filtered, gold recovery should have equalled that of the Chiddey method.

On the theory that silver is harder to precipitate, a solution of $NaAg(CN)_2$ was prepared, with 1 g. of $CuSO_4$ per liter as an impurity. Filtration was used here in both Chiddey and lead-acid methods to guard against particle loss. Results (Tables II and III) show an advantage for the lead-acid method.

The tests were repeated with gold substituted for silver. This time filtration was not used in any of the tests. Results (Table IV) again show an advantage for the lead-acid method.

The effectiveness of the lead-acid method was then tested on solutions obtained from cyaniding a rich copper-gold ore. Results appear in Tables V and VI.

Method's Advantages

Summarizing the foregoing results, the following advantages of the lead-acid method are noted:

1. Higher recovery of precious metal from most cyanide solutions.

2. Faster work. The estimate for the lead-acid method is 20 minutes; for the Chiddey method, 30 minutes.

3. Fewer, and more common, materials are used in the lead-acid method than in others.

4. Decantation can be used on ores that would require filtration under the Chiddey method.

5. The lead-acid method yields higher recovery of gold from pregnant solutions than does the lead boat method.

6. The superior accuracy of the lead-acid method is believed to be a characteristic of the method itself rather than a result of any special operating skill.

This description of the lead-acid method is offered in the hope that cyanide chemists will try it for themselves and report their experiences with it.

The Hoskold Formula Is Justified

Mr. Pardee defends use of formula in valuation of mineral properties against attack made upon it by D. H. Eldridge in article published in E. & M. J. last August

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Mining Engineer
Michigan Geological Survey

ONE PHASE of the subject of the valuation of mineral properties was discussed in the article, "Is the Use of the Hoskold Formula Justified?" which appeared in *Engineering & Mining Journal*, August, 1949. The author, Mr. Eldridge, an economist, confined his attention to a mathematical analysis of the two-interest-rates phase of the Hoskold formula and from this study came to some conclusions about the valuation of mineral properties and investments that cannot be accepted without question. In the article, Mr. Eldridge states that the use of two interest rates in the Hoskold formula "results in an undervaluation of mineral properties" and that "the logic of the formula is in accord with neither the principles nor practices of investments in mineral assets." He also refers to the Hoskold formula as a "complicated rule of thumb that appears to have little economic justification."

Formula Merely a Tool

In considering these statements, it might be well to note, first, that the Hoskold formula is not the factor in the valuation of a mineral property that deserves the greatest attention. This formula is merely a tool by which the present worth is determined from the *expected* profits of the operation over its *probable* life. These estimated factors of expected profits and life are substituted in the formula using certain interest rates to obtain the computed valuation of the mineral property in dollars. The fact that all valuations deal with the future income and life of the property makes the selection of the proper figures to use for the expected profit and life a matter of judgment that requires a knowledge of all phases of mining engineering, from the geology of the district in which the property is located to the economics and future demand of the mineral produced. No valuation is any better than the engineer doing the work and it is very easy to see why the correct evaluation of all the facts that are assembled into the life and expected income figures is so important. It goes without saying that this part of the valuation process is not done by "rule of thumb" methods, but requires professional knowledge and judgment of the highest caliber.

Some slight justification can be found for the position taken by Mr. Eldridge in his emphasis on the importance of the mathematics in the mineral valuation problem. Most of the literature on this subject abounds with formulas in which various ideas are expressed. The textbooks used by most engineering students are full of formulas and tables dealing with mine valuations. For example, the book on "Mine Examination and Valuation," by Baxter and Parks, devoted half of its pages in the first edition to the development of the mathematical formulas and tables derived from these formulas and practically the same ratio applies to the second and third editions of this text.

Most writers on the subject of mineral valuation realize that the engineers and geologists dealing with this subject are fully aware of the importance of the factors that must be substituted in the Hoskold formula. For this reason they are likely to assume that the reader holds the same viewpoint and gives more attention than warranted to mathematical studies designed to cover certain situations. The fact that the use of two interest rates in the formula will give a lower valuation than the use of one rate is not new, and the effects of various interest rates are shown by the tables that accompany every textbook on the subject. In these texts it is usually emphasized that the selection of the interest rate or rates in the formula allows the valuing engineer to make a decision that will materially influence the final result and that the rate or rates used must be directly related to the other factors that enter the valuation.

Whether or not the investment in mines or mineral property is of "a unique economic nature," as Mr. Eldridge seems to doubt, the fact remains that, although such investments are subject to the general hazards of all industry, they have one characteristic that differentiates this type of enterprise—the eventual exhaustion of the mineral deposit. This exhaustion may come unexpectedly or be evident over a long period, but there is always a point where production must stop. Other enterprises may also have to deal with the vagaries of nature, but a limited life is a feature that is peculiar to mining projects. For instance, a farm is an example of an enterprise that has to deal with all of the hazards of natural forces, but only in a few instances is the total value of a farm exhausted permanently. This limited life of a mineral property must be recognized in any valuation, and use of the life factor in the Hoskold formula is one method employed by mining engineers to achieve this result.

Trend Toward Lower Rates

Use of the high rates for the return on a mining investment (10% and over), advocated by Hoskold, were discarded by most engineers many years ago. It was realized that the use of a high rate of interest would introduce a greater speculative discount in a mine having a long life than it would for a mine with a limited future. The trend in recent years has been toward lower interest rates for the money invested. Thus the speculative nature of the enterprise is measured in a more accurate and realistic manner than by the use of a high interest rate. A good illustration would be the valuation of a mine in a district that has had a history of severe water problems in many of the mines. The engineer making a valuation of a new property in this district would estimate the chances of the possible excess pumping cost, and would modify the factors of cost or would discount the computed valuation according to his judgment of the importance of this water problem.

This procedure can be followed in areas where geogolical, operating, and economic conditions are

fairly well known. In new districts or where much of the information on which the valuation is based must be speculative, the engineer can either use a higher interest rate to express this condition of uncertainty or modify the valuation in some other way. Whichever method is used, it still does not violate the "principles nor practices of investments in mineral assets."

The Sinking Fund

The main objection by Mr. Eldridge to the Hoskold formula is the use of the lower interest rate in the sinking fund, or, what actually is more important, the difference between the interest rate for the investment and that for the sinking fund. Here again prevailing conditions determine the rates to be used and also give the engineer an opportunity to call upon his experience and judgment.

It is argued by Mr. Eldridge that the investor in mining and mineral deposits does not put his returned capital in a safe project that has a low interest return. This is true in many cases. R. C. Allen, when State Geologist of Michigan, made that observation over 30 years ago in his report on the tax value of the Michigan iron and copper mines. Mr. Allen took the position that the iron and copper mining companies in Michigan did not buy safe bonds with their returned capital but that they put the money back into the business in which they were engaged. In this case, Mr. Allen was making a valuation of units of a continuing industry, in which the mines in most cases were located in areas that had from 30 to 50 years of mining history on which to base his judgment of the future. This policy has continued in Michigan in valuations for tax purposes since Mr. Allen's time and the rates used over the past 30 years have been 6% for both interest on the investment and for the sinking fund.

The method described cannot be followed in the average mineral valuation where there is a lack of factual and historical information and the intent of the investor is unknown. In most cases it must be assumed that the valuation is to be made for some abstract individual whose use of his capital after it is returned is of no concern to the valuing engineer. The engineer used a low rate of return for the sinking fund merely because he knows that most people try to keep their money earning something rather than to hoard it in some safe place. This abstract person for whom the valuation is made, "the willing seller or the willing buyer," should not have a valuation thrust at him with the idea that by seeking a high interest rate on his investment he is in duty bound to reinvest his returned capital at the same rate.

The criticisms of Mr. Eldridge would be much more acceptable if some practical examples could be shown to illustrate the alleged undervaluations of mineral properties. Many comparisons have been made between valuations and sales, but practically all are of the type that sets the valuations made in the early stages of the mine development against sales made years later after development or mining has supplied definite information. The conditions that later appear obvious were probably very much obscured or even unknown when the original valuations were made. The comparison of actual sales with valuations made at the same time is the only fair way to judge the overvaluation or undervaluation of any mineral property, but these figures are difficult to obtain. Sales of stock are not always good for comparative purposes, as these stock prices often include other assets or in many cases reflect mass enthusiasm or disappointment that should have no bearing on a factual engineering appraisal.

Use of Formula Upheld

Actually, the use of the Hoskold formula has been upheld in many court decisions[1] and has been included in the computations by engineers and geologists in setting up valuations for the purchase and sale of mineral properties. It would seem that the courts, Federal and State taxing authorities, and sellers of mineral property would not accept valuations obtained by the use of the Hoskold formula if the use of this formula consistently resulted in an "undervaluation."

Other Factors Than Formula

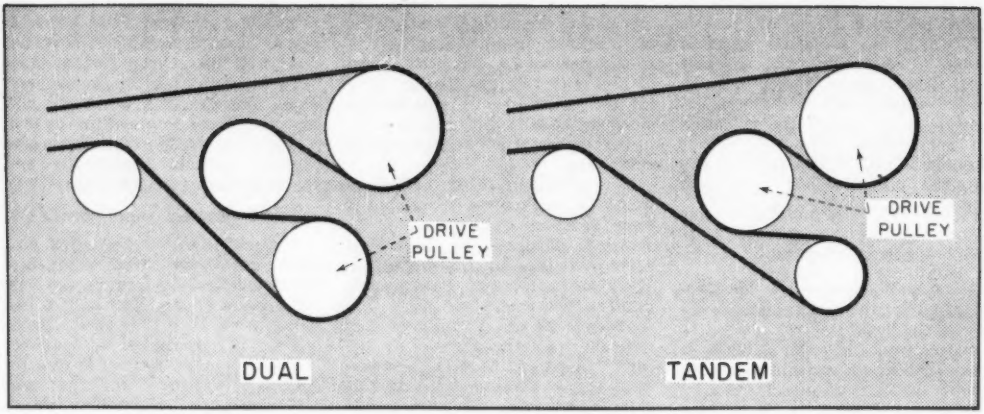
The article under discussion implied throughout that engineers using the Hoskold formula are not fully aware of the effect of two interest rates, or, if they realize such effect, they continue to use the "rule of thumb" procedure due to custom or for the definite purpose of obtaining a "reasonable" valuation for tax or other purposes, to quote Mr. Eldridge again. The incomplete mathematical analysis of the Hoskold formula, which is only *one* part of a mineral valuation calculation, does not justify such conclusions on the comprehensive subject of mineral valuations. The important thing to remember is that the priceless ingredients of any mineral valuation are the integrity, knowledge, and judgment of the engineer or geologist doing the work. Experienced and competent members of these professions have no difficulty in arriving at honest and economically sound valuations when their calculations include the use of the Hoskold formula.

[1]Minnesota vs. Oliver Iron Mining Co., 198 Minnesota 385, Newport Mining Co. vs. City of Ironwood, 185 Michigan 688, State Tax Commission vs. Magma Copper Co., 15 Pac. 2nd 961.

Underground Conveyors Studied by Bureau

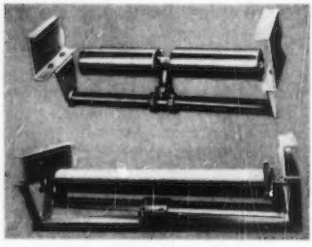
RESULTS OF STUDIES by the U. S. Bureau of Mines in the Lake Superior district will not permit the establishment of any formula to prove or disprove the advantages of belt or shaker systems at all underground mines. They do show that such haulage can be used to advantage where the proper conditions exist. Advantages are particularly apparent when development can be planned sufficiently in advance of exploitation to permit installation of belts or shakers as part of the development program and where the systems are extended to include haulage in stopes as well as main entries.

Belt and shaker conveyors, used singly or as combined units, have for many years been an integral part of many coal-mine haulage systems, the Bureau states in Information Circular 7526 recently issued. The belt conveyor has also been used extensively as a main-haulage unit in open-pit iron-ore mines of the Lake Superior district, particularly on the Mesabi Range. Few underground metal mines, however, either in the ferrous or non-ferrous branches of the mining industry, use the conveyors exclusively or even extensively for underground haulage. At present, only five iron-ore mines in the entire Lake Superior district have belt- or shaker-conveyor installations of any significant size. Of these mines, three are in the Iron River-Crystal Falls district of Michigan on the Menominee Range, one is on the Marquette Range near Ishpeming, Mich., and one is on the Mesabi Range near Keewatin, Minn.



IN THE DUAL DRIVE both drive pulleys work on same side of belt, making it preferable to tandem drive for dirty or abrasive material. In the latter drive one pulley has to work on the dirty side and material may build up on it, affecting speed and stress calculations.

Build Your Belt Conveyors



SELF-ALIGNING IDLERS automatically adjust themselves to correct belt if it tends to run to one side. Upper advanced design shown here has two or more separate rolls carried on center bearing, which permits pivoting in inclined plane.

STANLEY M. MERCIER
Chief Engineer
Jeffrey Manufacturing Co.
Columbus, Ohio

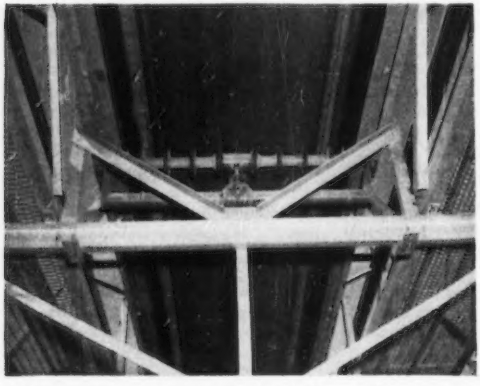
USE OF BELT CONVEYORS for transport,* as compared with truck haulage, is subject to certain restrictions. At the same time, it has certain advantages. The restrictions are three in number:

1. Restriction as to the size of pieces which may be handled. The size of the pieces should not exceed one-third of the width of the belt and should preferably be held to a quarter of it, if the belt is fully loaded and traveling at high speed, for example, 9 to 12 in. maximum for 36-in. belt, and 15 to 20-in. maximum for a 60-in. belt.

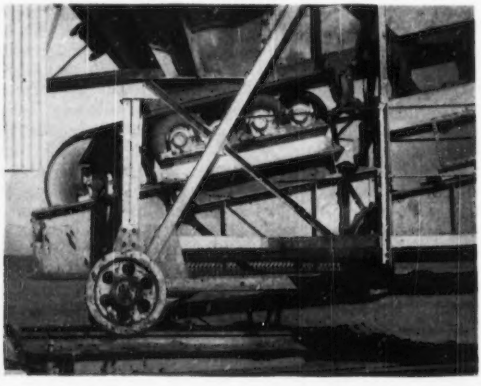
2. Belt conveyors are not nearly as flexible in application as some other transport means. Points of loading and points of distribution are not so readily varied.

3. Capital costs are relatively high for small, simple operations, but this handicap diminishes and disappears on larger and more difficult jobs. In other words, these costs per ton diminish at a greater

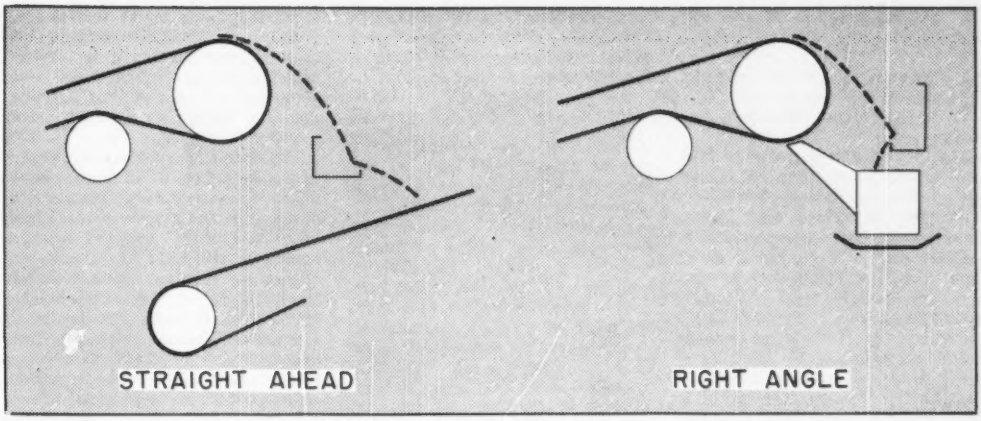
*Arranged from address made at University of Minnesota's Mining Symposium, Duluth, Jan. 18-19, 1949.



RUBBER-TIRED, SPOOL-TYPE RETURN IDLERS transfer wet, sticky material off the belt, but do not let dirt build up on spools.



CUSHION IDLERS are necessary for unsized material. Designs, based on using spring characteristics of rubber, are available.



AT TRANSFER POINTS, stone box offers yielding cushion for large pieces of ore, reduces belt maintenance. Wear is taken on the material itself. Some adjustment should be possible to permit location in best position. Most damage occurs at transfer points.

To Make Them Last Longer

rate as the haulage rates or haulage slopes increase.

On the other hand, belt conveyors possess certain definite points of advantage:

1. Operating costs, including power costs and maintenance costs, are strikingly low, probably lower than for any other form of land transportation.

2. Operating efficiency is high. Interruption in service and lost time due to conveyor breakdown may be expected to be less than for other means of transportation.

3. In operations that allow the belt line to be loaded directly through a hopper, the operating efficiency of the digging means will be higher.

4. Haulage grades and road maintenance are less of a problem. Conveyors can handle 30% grades as easily as 10% grades or level operations.

5. The good qualities of conveyors and trucks can often be combined to advantage by using the flexibility of the trucks in gathering from the digging unit and the low haulage cost of the belt conveyors thereafter.

The question as to how power is distributed in a belt conveyor system often comes up for discussion. The figures in Table 1 for a typical installation should be of interest. It should be noted that the power required for lifting material is common to all devices. Note also that the figures given in the table for a belt conveyor are for the round trip, or full cycle, including the return journey of the haulage means.

If there is any down-hill haulage in part, or all, of the journey, the belt conveyor will return this power to the line instead of burning it up in brakes and road maintenance.

The principal ways in which the friction power is dissipated are:

1. As bearing friction in idlers and terminals.

TABLE I—Distribution of Power in a Belt Conveyor System

Slope	Level	+10%	+20%	+30%
Angle	0	6°	11.3°	16.7°
Material Lift	...	67%	80%	86%
POWER USE		Percent of total power used		
Material Friction	60%	20%	12%	8%
Machinery Friction	40%	13%	8%	6%
Total Power	100%	100%	100%	100%

TABLE 2—Comparison of Belt Conveyor Drives in Common Use

Type Drive	Usual Angle of Wrap	Drive Factor (Counter-weighted)	Use
Bare Plain	180°	0.64	Misc.—Small units
Lagged Plain	180°	0.50	Misc.—Small units
Lagged-and-Snubbed	210°	0.38	General, Inclined
Tandem	420°	0.08	Large, Near Level
Dual	420°	0.08 to 0.11	Large, Near Level

TABLE III—Comparison of Snub With Two Dual Drives

	210° Snub	420° Dual	420° Dual
Proportionate Motor Sizes	1-150 hp.	50 hp. & 100 hp.	30 hp. & 120 hp.
Effective Tension Factor	150	150	150
Initial Tension Factor			
0.38 x 150	57		
0.38 x 50		19	
(0.38 x 120)—30			16
Total Tension Factor	207	169	166

2. In manipulation of the belt as it passes over idlers and round pulleys.

3. In manipulation of material as it passes over the idlers.

4. In acceleration of material at loading point.

Just how the total power of friction should be distributed among these items is not too clearly known or agreed on. Their total varies widely with the different materials handled and will be much lower when handling small coal or dry sand, for instance, than when handling lump coke.

Industry practice is to provide for all these losses by allowing a power factor equal to 3% of the total load in motion, that is, belt, idler rolls, pulleys, and material (plus a factor of the belt tension from all causes to cover friction in terminal pulleys due to the belt pull on those pulleys). It is sometimes argued that this allowance of 3% is excessive and may be reduced to three-quarters or two-thirds of this amount. The figures given for the distribution of total power show that the amount in question is a minor part of the whole. An insufficient allowance would result in the conveyor being underpowered and underbelted and so increase operational troubles and expense. For these reasons I consider it wiser to be conservative in allowing for friction, unless it is definitely known that the conditions being considered duplicate those for which a lower value can be demonstrated. Test of conveyors in service do not show that this friction value is controlled conclusively by the arrangement of machinery or the quality of maintenance control.

Correct Selection of Drive Is Important for Economy

I wish to emphasize the importance of the belt itself in a belt-conveyor system. The distribution of capital costs for a typical example is as follows: Belt, 36%; idlers, 18%; drives, 21%; and structures, 25%. The first item, belts, will have to be replaced completely from time to time, say every six to ten years, depending on service, and this in addition to some operating expense for regular maintenance. The design of the system should center around the belt itself and employ all reasonable means for economy in this item. Economy will not be found in reducing the belt cost by increasing the number of transfer points because it is here that most of belt degradation occurs. Economy can be effected by a wise selection in the type of drive, so that the necessary strength of the belt is kept down.

General Principles

For clarity, the general principles of a belt drive and the terminology used in discussion may be reviewed as follows:

A belt is driven by a drive pulley connected to a source of power, such as a motor. The belt is wrapped around this pulley and held in pressure contact with it. As the angle of wrap or the pressure is increased, the amount of power developed is increased. Variations in pulley surface affecting the coefficient of friction will vary the effectiveness of the pressure contact. Pressure contact is obtained by supplying initial tension in the belt. The relationship between the initial, or "slack side," tension and the force developed in the belt by the motor, or "effective tension," is called the "drive factor." The sum of these two tensions is alluded to as the "total tension" or "tight-side tension." The symbols T_s or T_2; T_e; and T_t or T_1 are frequently used to denote these values.

When a belt conveyor is operated on a slope, the weight of the belt itself produces a tension value at the head pulley, and this tension may easily exceed the minimum slack-side tension indicated by the drive factor. To load the belt conveniently at the foot of the slope, a minimum tension must be supplied at this point and added to the "slope tension" of the belt. The "maximum tension" on which the belt must be designed and selected is found by comparing these tensions caused by slope with the slack-side tension required for driving and adding the larger to the effective tension.

Another factor which governs the selection of the belt is "body" strength. This depends on the nature of the load handled. Large lumps and heavy material or heavily-loaded belts require more body accordingly and so fix a minimum design of belt to use.

For conveyors which are long and not steeply inclined, it is economical to select a drive requiring the least drive factor. The possibilities of this economy are shown in Table 2.

Despite the obvious economy shown for a tandem drive on a level conveyor, a very serious objection to this type may be made, namely, that one pulley has to work on the dirty side of the belt. Material may build up on this pulley, or may wear the pulley lagging and the belt cover, and so upset design assumptions as to belt speed and distribution of stress. For dirty or abrasive material, the dual drive is to be preferred.

The reason for the possibly poorer factor in a dual drive is that each pulley is separately driven by its own motor, and motors of ideal proportionate sizes are not always available. Moreover, this is also an advantage in many cases because the drives in a system of conveyors may be more easily standardized. For example, in one recent job dual drives consisting of 100- to 200-hp. motors were used, which together equalled 300 hp., because, at different drives, each one of these three combinations fitted the existing conditions. In another case, a combination of 30 hp. and 125 hp. (total 155 hp.) was used for the same reason. The figures in Table 3 show the proportionate economy in belt when compared to a lagged-and-snubbed drive.

If a seven-ply belt is sufficient for the average need of the dual drives, then nine plies would be needed for the snub drive.

As to Belt Idlers

Belt idlers have one duty to fulfill and that is to support the belt and its load adequately without asking for too much attention. Proper spacing of them is largely empirical because of the variable factors which govern it. With respect to the idlers, the load supported and the belt speed must allow reasonable bearing life. As to the belt, the idlers must hold it fairly well to shape. Excessive sag or bellying between idlers will shorten belt life and increase power demand. The sag is, of course, directly related to belt tension, and for this reason some authorities urge that idler spacing should be varied. This is theoretically sound, so far as the belt is concerned. But if the requirements for idler-bearing life are observed and account is taken of the increased cost of fabricating stringers, the economic value of the idea becomes uncertain.

In addition to supporting the belt, the idlers must train it. Slotted holes are used for bolts securing the idlers to stringers so that they may be cocked slightly for training purposes. It is also usual to tilt the idlers forward slightly, which makes the end rolls toe in with the same beneficial results as "toe in" produces in the front wheels of an

automobile. It has been my experience that similar benefit is found in increasing the length of the center roll and thus increasing the contact of the center portion of the belt.

Self-aligning idlers automatically adjust themselves to correct the belt if it runs to one side. Several makes of self-aligning troughing idlers are available and all are satisfactory. However, the return run of belt really needs more protection than does the carrying run. It is out of sight and can easily be damaged by running to one side and dragging on idler brackets or conveyor stringers. Most self-aligning return idlers are made with a single roll, and this design is sluggish and reluctant to roll on any axis not normal to the belt center line. An advance design consists of two or more separate rolls carried on a center bearing, which allow the idler to pivot in an inclined plane. When the belt runs to one side, its weight and its tractive efforts cause the idler to tilt down and forward on that side. Using two or more rolls increases the liveliness of the idler's response.

Belt conveyors which handle wet and sticky material and specially under below-freezing conditions have trouble caused by material building up on return idlers and upsetting the training of the belt. For such conditions, rubber-tired spool-type return idlers are preferred. They will transfer material off the belt, as straight idlers do, but the dirt will not build up on the spools. If these spools can be shifted on their shafts so that a succession of them contact the entire surface of the belt, it will minimize build-up at subsequent terminal and bend pulleys. Soft-rubber covers on bend pulleys, which contact duty belts, will appreciably minimize the tendency for material to form frozen crusts on these pulleys.

At Transfer Points

Most of the causes of belt damage are found at transfer points and serious damage may occur through inadequate protective measures. Because most materials contain both lumps and fines, and because fines are often sticky, it is usually difficult and often impossible to arrange a transfer chute which will cushion the lumps without having it plug up with fines.

For rough materials, a stone box seems to offer the best basis for a solution. This arrangement offers a yielding cushion for the large pieces to land on and tends to glaze over when fines predominate. Inasmuch as the wear is taken on the material itself, maintenance expense is greatly reduced. Somewhat more headroom should be allowed for a stone box transfer because a material's angle of repose is less on itself than on a steel chute. Because any transfer chute should deliver the material in the same direction as the departing belt, it is desirable to provide some adjustment in the stone box which will permit it to be located in the best position. For any "straight-on" transfer, the stone box need not absorb the forward energy in the material. Where a radical change in direction is required, it is best to cancel out the forward energy, or trajectory effect, so that the material falls vertically and may be caught on a second surface, or box, headed in the new direction.

Big Pieces Cause Damage

No matter what sort of transfer chute is used for materials containing both lumps and fines, there will always be surplus energy in the larger pieces. The impact of large pieces causes obvious damage in the shape of cover cuts, but it may cause less obvious and more serious damage to the carcass in bruises and broken threads. Usually carcass damage does not also cause a cut in the top cover but may be felt on the pulley side as a ridge, or irregularity, or as a break in the pulley cover.

Some sort of cushion idlers are necessary for handling unsized material. There is an assortment of cushion-idler designs, all based on employing the spring characteristics of rubber. None are perfect for all conditions. This is to be expected, inasmuch as each lump represents a different energy problem. Our own design attempts to provide a thick rubber-covered roll whose spring rate increases as the deflection. This is done by providing relieving grooves of varying depth in the rubber.

Some work has been done with pneumatic tires arranged in various patterns to support the belt. Air is a perfect spring, and pneumatic tires offer much greater total deflection than is commercially available in solid-rubber cushion idlers. However, the large diameter of tires results in large areas of unsupported belt where the belt itself must be the cushion for pieces that do not land directly over a tire. There is need for further experiment in this field, both as to the best size and best arrangement of tires, suitable proportioned shafts and bearings to support them, and means for retaining proper inflation. Pneumatic-tire idler nests cost from three to five times as much as an equivalent (area) nest of solid-rubber cushion idlers and so should only be used in extreme cases until more experimental work justifies them. I might add that my preference at present in pneumatic-tire arrangement favors putting them in line rather than staggered.

Causes of Belt Damage

A conveyor belt is completely destroyed only when the carcass can no longer pull and hold the load. Some principal causes of belt degradation are as follows:

Carcass damage due to imperfect loading of large lumps.

Carcass damage, or creasing, due to handling a cross section of load which is excessive for the belt carcass used.

Carcass damage due to excessive belt tension or flexing over too-small pulleys.

Carcass damage due to moisture getting in through damaged or worn-out cover.

Inasmuch as belts represent over one-third of the investment in a belt conveyor and will have to be completely replaced in from six to ten years, and inasmuch as more maintenance time and money will be spent on them than on all the machinery and structures, they are clearly the most important part of the system. The following cautions in regard to belt selection and care may well be noted:

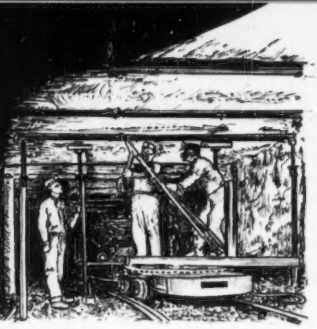
1. Don't underbelt in the first case because a belt which is overworked must surely be replaced sooner than one which is conservatively applied.

2. Don't have any more transfer points than necessary because it is here that the life is taken out of a properly designed belt.

3. Study your transfer points to get the best possible cushioning. Each one is a separate problem and can only be perfected by study and experiment on the job.

4. Be diligent in making all repairs to carcass and cover as promptly as possible, because damage to either covers or carcass is always progressive. The lowest operating costs are found in those plants where a rigid inspection and repair program is enforced.

KEEPING TAB ON PRACTICE



Carbide-Tipped Forged Steel First in Field. Despite the excellent results obtained with detachable carbide bits by many operators, the problem of securing a satisfactory connection between bit and rod (under presumably different conditions) has given enough trouble to other users to make any proposed remedy attractive. It is to meet this need that resort has been had to the use of steel with carbide-tipped forged bits on the end integral with the rod, such as were described on this page in the August and December issues, 1949.

It may well be recalled that the first use of tungsten carbide in rock drilling that was brought to the attention of *E&MJ* readers (Feb. 1947) had to do with steel of this sort. The drilling practice then described involved the use of the 4½-ft. chisel-edged jumper steels tipped with carbide, all of Swedish make, that were being used by operators on the Rand, South Africa, in competition with detachable steel bits. Such steel had previously been employed extensively in Germany and Sweden. Subsequently, on this side of the water, the detachable type of carbide bit took the field, mainly in the two- and four-point types, and, after prolonged testing, found wide acceptance. The present growing practice, therefore, of using carbide-tipped forged steel, the bits of which are *not* detachable, is something to be watched. At first sight, it suggests a reversion to the practice of using old-fashioned sharpened steel which preceded the use of detachable steel bits and still lingers in places. But the number of pieces of forged steel with carbide tips that have to be distributed or taken to the working places today in any mine is only a small fraction of the amount of sharpened steel that the nipper formerly had to distribute in that mine and recover to be resharpened.

Tipped Steel for Roof Bolting. Instances of current use of carbide-tipped forged steel multiply. Among the companies employing it is Tennessee Coal, Iron & Railroad Co., Birmingham. The iron ore mines of that company are using alloy drill steel with carbide-tipped forged bits for drilling holes for pin timbering, that is, roof bolting. These holes are drilled 5 to 8 ft. deep into the shale and sandstone immediately overlying the ore seam. One-inch wedged bolts are inserted in the holes with washers and nuts for supporting the roof.

This type of steel has been in use since the beginning of roof bolting. The hard abrasive sandstones of the top strata could not be drilled economically using conventional steel bits. Other types of tungsten-carbide bits proved unsatisfactory, due primarily to breakage of steel or breakage at the connection.

Specifically, ⅞-in. quarter-octagon alloy drill steel is being used, having a single-piece, 1¼-in. chisel-type insert of carbide. Gage ranges by 0.020 in. from 1.264 in. to 1.244 in. There are six lengths to a set, namely, 2 ft., 3 ft. 6 in., 5 ft., 6 ft. 6 in., 8 ft. and 9 ft. 6 in. The gage drop between each length is 0.004 in. Depending on the height of the ore and the depth of hole to be drilled, the 8-ft. and 9 ft. 6-in. steel may possibly not be used.

The drills used are of the medium-weight stoper type, 90-lb. class. Several makes are employed.

Footage drilled per set of steel varies with the character of the top strata. In the working places where the footage is lowest, one set of steel is required for five sets of drilling.

Makes Own Carbide-Tipped Steel. Mountain Copper Co., Matheson, Calif., is experimenting with hard-metal insert bits formed on the rod and not detachable. These are made in its own shop. C. W. McClung, superintendent, thinks they will have a successful tool. Decision to try this type of drill bit was based, first, on their inability to find a successful means, under their conditions, for coupling bit to rod. The detachable carbide bits tried have been good, but in most cases the coupling wore out before the bit, and in other cases, where the life was the same for bit and coupling, the rod was fatigued to the point of discard. Another factor has been the high price of bits now on the market. This, according to Mr. McClung, makes them susceptible to loss through "high-grading," regardless of the usual methods of control. He thinks they will be able to make a bit on the rod for one-half to one-third of the present cost of the carbide bits they have been buying.

This superintendent is convinced that hard-metal bits on alloy-steel rods are the correct combination for drilling his rock. He looks forward to seeing rock drills designed specifically for use with hard-metal bits. He anticipates that they will be smaller, will strike a faster and lighter blow than those now used, and will require higher air pressure.

In respect to the last, it is interesting to note that G. H. Cave, of Rip Bits Ltd., Sheffield, England, says in a letter that improvement in the design and manufacture of carbide bits will very soon permit them to be used with machines of any weight, including heavy drifters and sinkers. Even now it appears (says Mr. Cave) that the limiting factor is not so much the body of the carbide bit or the bonding of the insert as it is the method of connection. He thinks that a large-diameter floating stud assembly will offer definite advantages over other types of non-renewable connection when carbide bits do come to be generally accepted for use with heavy drifters.

With Forged Steel Dispensers. For some time past, Rock Bit Sales & Service, Philadelphia, has been making forged drill steel with an attached tungsten-carbide insert. They have held back from offering it to the general user until a more universal drill steel was obtainable and production facilities could be completed. They now can supply it, under the name of Intraset drill steel, either in a 2-point or a single-point bit. They cite the following sizes:

⅞ in. hex.	Bit size, 1⅛ to 1⅝ in.
⅞ in. Q.O.	Bit size, 1⅛ to 1⅝ in.
1-in. hex.	Bit size, 1⅜ to 1¾ in.
1-in. Q.O.	Bit size, 1½ to 1¾ in.
1¼ rd.	Bit size, 1½ to 1 ¼ in.

This steel, they claim, has been tested in more than 25,000 pieces in all types of drilling.

Also from the same company comes a new detachable bit with crowned tungsten-carbide inserts, intended to increase drilling speed, and self-cleaning chip channels. They call it the Rok-Drill bit. See page 100. Breaking of carbide edges has been eliminated, they claim. Threads are designed for each size and application to overcome premature failure. Air holes have been placed to give better blowing, cut air used. The bit comes in a 2-point chisel type, 1½ in. to 4 in. in diameter, and in a 4-point cross-bit type, 1⅜ in. to 4 in. in diameter.

O. J. Black, Bishop, Calif. (see Aug. *E&MJ*, p. 80 and Dec. *E&MJ*, p. 88) says he has improved both his insert steel and his shop methods. He is now making 1-in. Q. O. stoper steel with a 1⅝-in. starter; also, for the Colorado sandstone miners, a skeleton bit on ⅞-in. steel for soft abrasive ores. Not having a joint, he says, he can give the bit a lot of clearance for fast cutting. The starter is 1 7/16 in. and the body 1 in. This still leaves room for ⅞-in. powder when the inserts are worn down to body size.

MARKETS—Trends and Prices (*Continued from page* 53)

Primary Aluminum Production

(Bureau of Mines)

Production of primary aluminum in the United States, in short tons, based on producers' reports. Monthly figures are preliminary and will not add to the totals derived from the Bureau's annual industry canvass. The drop in output in September and October of the current year resulted from strikes.

	1943	1944	1945	1946	1947	1948	1949
January	60,650	84,750	48,650	24,750	50,045	48,767	53,356
February	55,600	74,400	45,650	22,250	47,002	45,699	49,749
March	64,600	80,200	53,100	26,000	53,032	51,874	54,852
April	66,800	77,800	51,600	25,900	51,007	53,277	54,076
May	72,850	76,450	52,000	24,850	51,116	55,450	56,909
June	74,150	66,400	47,500	27,800	46,259	48,557	54,184
July	78,450	67,550	47,900	35,750	47,998	52,937	55,777
August	81,350	61,650	45,800	39,850	47,054	54,953	52,001
September	86,400	47,450	31,600	41,100	43,228	53,255	49,742
October	94,050	48,400	25,000	45,000	43,959	54,526	45,790
November	91,350	44,450	20,800	46,300	43,461	50,714	.....
December	93,600	46,850	24,000	50,700	47,589	53,474	.....
Total preliminary	919,850	776,350	493,600	410,250	571,750	623,483	.....
Total final	920,179	776,446	495,060	409,630	571,750	623,456	.....

Official London Prices

Though trading in Tin on the London Metal Exchange has been resumed, beginning with Nov. 15, the British Ministry of Supply continues to fix delivered prices of copper, lead, and zinc for the United Kingdom. Quotations in effect on the last day of December were as follows:

	Per Long Ton £	s.	d.
COPPER:			
Electrolytic, high conductivity	153	0	0
Fire refined, high conductivity	153	0	0
Fire refined, high grade	152	10	0
Fire refined, min. 99.7 percent	152	0	0
Fire refined, min. 99.2 percent	151	10	0
Hot rolled black wire rods	159	0	0
LEAD:			
Soft, foreign duty paid	97	0	0
Soft, Empire	97	0	0
English, refined	98	10	0
ZINC:			
Foreign (G.o.b.) duty paid	85	10	0
Domestic (G.o.b.)	85	10	0
Prime Western and debased	85	10	0
Refined and electrolytic	86	5	0
Minimum 99.99 percent	87	15	0

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipment, f.o.b. New York unless otherwise stated

MISCELLANEOUS METALS

(December 31, 1949)

Aluminum, ingot, 99 plus percent, lb. (base price)	17c.
Antimony, spot, lb., 5 tons and up but less than carload, in cases	35.25c.
Bismuth, ton lots, lb.	$2.00
Cadmium, commercial sticks, delivered, lb.	$2.00
Calcium, lb., ton lots, 98 percent, cast	$2.05
Chromium, 97 percent grade, lb., contract	$1.07
Cobalt, 97 to 99 percent, per lb.	$1.80
Indium, troy oz.	$2.25
Nickel, cathodes, lb., f.o.b. Port Colborne (at	40c.
Magnesium, 99.8 per cent, carloads, lb., producer's plant	20½c.
Palladium, troy oz.	$24.00
Platinum (Official quotation wholesale lots) troy oz.	$69.00
Quicksilver, flask of 76 lbs., 25 flasks or more	$71.00
Selenium, 99.5 percent, lb.	$2.00
Silicon, minimum 97 percent, spot, carloads, lb.	16.50c.
Tellurium, lb.	$1.75 nom.
Thallium, 100 lb. or more, lb.	$15.00
Titanium, 96 to 98 percent, lb.	$5.00

(a) Includes U. S. duty

METALLIC ORES

Beryllium Ore, imported, 8 to 12% BeO, per unit	$26.00@$30.00
Chrome Ore, per long ton, f.o.b. cars Atl. ports, dry 48% Cr_2O_3, 2.8 to 1 ratio	$35.00
48% Cr_2O_3, 3 to 1 ratio	$37.50@$39.50
Iron Ore, Lake Superior, Lower Lake ports, long ton:	
Old Range bessemer	$7.60
Mesabi bessemer	$7.35
Old Range non-bessemer	$7.45
Mesabi, non-bessemer	$7.20
Lead (Galena), 80 percent, Joplin, Mo., ton	$147.67
Manganese Ore—Per long ton unit of Mn basis 48 percent manganese subject to premiums and penalties, 76@78c., c.i.f. U. S. ports, duty extra.	
Molybdenum Ore, 90%, per lb. of MoS_2 f.o.b. mines	54c.
Tantalite, 60% concentrate, per lb.	$2.00@$2.75
Tungsten Ore, per unit of WO_3	
Foreign, 60 percent, duty paid	$18.50@$19.00
Domestic, scheelite, 60 percent and upward	nom.
Vanadium Ore, per lb. of contained V_2O_5 f.o.b. mines	27½c.
Zinc Ore, Prime, 60 percent concentrate, Joplin, Mo., per ton	Nominal

METALLIC COMPOUNDS

Arsenious Oxide (arsenic trioxide) lb., in bbl. carload lots delivered	5½c.
Cobalt Oxide, 72%, metallurgical grade, per lb. of Co	$1.95
Copper Sulphate, 100 lb.	$7.00

ALLOYS

Beryllium Copper, 4 percent Be, per lb. of contained Be	$24.50
Ferrochrome, 65 to 69 percent, per lb. of Cr contained	18.80c.
Ferromanganese, 78 to 82 percent, gross ton, seaboard	$172.00
Ferromolybdenum, 55 to 65 percent Mo, lb. of Mo. contained	$1.10
Ferrosilicon, 50 percent, per lb. of contained Si	11.3c.
Ferrotungsten, 75 to 80 percent, lb. of W contained	$2.25
Ferrovanadium, per lb. of V delivered	$2.90
Silicomanganese, 1½ percent C, per lb. contracts	8.6c.
Spiegeleisen, per long ton, 19@21%	$65.00

NON-METALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (U. S. funds), ton:	
Crude No. 1	$960@$1,050
Crude No. 2	$492@$550
Spinning fibers	$232@$475
Shingle fibers	$95.50@$141
Paper stock	$78.50@$88
Waste	$58
Shorts	$27@$52
Vermont, f.o.b. Hyde Park:	
Shingle stock	$97.00@$107.00
Paper stock	$68.50@$85.00
Waste	$51.00
Refuse or shorts	$25.50@$46.50
Barytes, f.o.b. mines:	
Georgia, crude, per long ton	$11.50@$12.00
Missouri, 93 to 94 percent $BaSO_4$, per short ton	$9.00@$9.50
Bauxite, long ton:	
Domestic, crude, 50 to 52 percent (not dried)	$4.00@$5.00
Domestic, chemical, 55 to 58 percent	(a)$8.50@$9.50
Domestic, abrasive, 80 to 84 percent	$18.00@$18.50
China Clay, f.o.b. mines, ton:	
South Carolina and Georgia, No. 1, airfloated bulk	$8.50@$9.50
North Carolina ceramic grade	$18.00@$20.00
Feldspar, bulk ton:	
Potash or soda feldspar, 200 mesh	$18.50
Glass spar, white, 20 mesh	$11.75@$12.50
Fluorspar, f.o.b. mines, bulk, Kentucky and Illinois, 70% effective, CaF_2, ton	$37.00
Acid 97% concentrate, bulk, ton	$43.50
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00@$14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington	$30.50@$31.00
Mica—Domestic f.o.b. mines. Punch, 12 to 22c. per lb. according to size and quality. Sheet, clear, 1½ x 2 inch, 70 to 75c.; 2 x 2 inch, $1.10 to $1.20; 2 x 3 inch, $1.40@$1.50; 3 x 3 inch, $1.70@$1.80; 3 x 4 inch, $2.10; 3 x 5 inch, $2.40; 4 x 6 inch, $3.15; 6 x 8 inch, $4.25. Wet ground, very fine, $1.20@$1.35 per ton. Bulk sales, dry ground, $32.50@$80.00 per ton. Scrap, $30 and up.	
Ocher, Georgia, ton, in sacks	$24.00
Pyrites, Spanish, per long ton unit of S, c.i.f. Atlantic ports	(a)12@14c.
Sulphur, Texas, mines, long ton	$18.00
Talc, f.o.b. works, ton:	
New York, purified	$18.50@$20.00
Vermont, extra white	$12.50
Tripoli, Missouri, ton:	
40 mesh, cream colored	$14.50

(a) Nominal

IRON AND STEEL

Pig iron, gross ton, basic, Valley furnaces	$46.00
Steel, f.o.b., Pittsburgh billets, net ton	$53.00
Structural shapes, 100 lb.	$3.40

WASHINGTON REFLECTIONS

McGraw-Hill Washington News Bureau

Treasury Looms as Stumbling Block For Mining's Tax Reform Proposals

The rumor was strong in Washington during December that the White House, anxious to head off a now-unpalatable O'Mahoney Bill, would consider suggestions for tax incentives of special benefit to mining. However, it was the consensus in informed circles that nothing of this sort would serve to kill the O'Mahoney Bill.

Also proposals for tax relief for mining will almost certainly run into determined opposition from the Treasury.

The Bureau of Mines has been trying for months to obtain the support of the Administration for some program of incentives to channel more investment into mining, particularly to small mining enterprises. Although the Treasury has listened, and admitted that there is a problem in vanishing venture capital, it has steadfastly refused to go along on anything that cuts into revenue. The only concrete thing the Treasury is for, so far, is a downward revision of percentage depletion, certainly no incentive. The Treasury is against further tax benefits to large corporations, which it feels are already too well off, taxwise, anyway.

Sen. O'Mahoney himself, claiming that S. 2105 is only a temporary expedient, is pushing hard for some revision of the present tax system. He recently called for a complete revision of the tax system to stimulate investment.

Speaking as chairman of the Joint Congressional Economic Committee, he said the Federal Government must provide tax incentives if it would solve the problem of "vanishing investment capital." He declined, however, to commit himself on any specific tax changes.

The National Minerals Advisory Council to the Secretary of Interior has turned in a report advocating changes in the tax structure. Nothing during December, however, indicated that the Treasury had been won over.

The magic word for the revisions, a selective device through which the small outfits could be helped while the large corporation's taxes remain unchanged, has not yet been developed. Until it is presented to the Treasury, and demonstrated to be workable, there will be no general acceptance by the Administration of tax incentives for mining.

What is needed, according to bureaucrats who know bureaucracy, is presentation to Treasury of masses of data proving every allegation made. The idea must be sold through painfully-documented evidence. For instance, adaptation to the U. S. code of the Canadian plan of temporary tax exemption for investors in new mining ventures. The code must be sold by proving that the loss of revenue will be made up in the long run by more new industry being born.

The Treasury is too technical-minded, they state, to be moved by mere assertions. This puts the advocates of tax relief up against an impossible objective. What an incentive will do is not definable in terms of technical proof. Even after experience is gained, there is always an argument over the effect of any single factor in shaping events.

Magic word or no, there will be a concrete effort to put some sort of tax revision proposal into Congressional language within the next month or two. Congress is ready to give any such proposal a thorough hearing. The stage is all set, and the villain (Treasury) is in the wings waiting for his cue, armed with a wagon-load of documents.

As for the probability of early passage of the O'Mahoney Bill, observers are certain it will pass Congress this session, but not in the next few weeks. The changes made by the House to the Senate's version must first be mediated. Proponents of the legislation are fairly sure of a veto if the measure goes to the President in the form passed by the House.

Other important legislation, which could mean help to the minerals industry, will go into hearings shortly. The idea of applying percentage depletion to all minerals, an unadvertised rider on a tax reform bill introduced late during the last session of Congress will be aired in the House. The amendment, which would have provided percentage depletion (15%) for "perlite, diatomaceous earth, tripoli, granite, marble, borax mines and deposits, sand, gravel, stone, calcium and magnesium carbonates, and all other non-metallic clays and minerals," was dropped in conference on the understanding that the whole depletion problem would be reviewed early in 1950.

Sen. Walter F. George, chairman of the finance committee, recently said that although tax reform is somewhat remote in view of the heavy deficit now being incurred by the Government, "I think it will be quite possible to trade the Administration out of some tax rates and out of certain taxes, because the Administration is going to need to get more money. And in getting more money I think certain of these inequitable taxes should be removed."

Public opinion is running so high against wartime excise taxes that their elimination seems most likely.

Early Action Seen On Stream Pollution

Federal action on industrial stream pollution across the nation is going to be pushed ahead this spring.

First thing to expect will be reports from the Public Health Service's division of water pollution control. These will put the finger on prominent examples of industrial pollution, including mining wastes.

These early reports will be the first signs of action from the new Federal agency created as the result of passage by the Republican 80th Congress of the Federal Anti-Pollution law. The agency got its first funds last summer, a total of $2,725,000. This is the first bite on a five-year program for which Congress has appropriated a total of $31,000,000.

The money is split up in several ways: loans to states and municipalities for drawing plans and for construction of sewage treatment plants. Grants to states and interstate pollution agencies for research on industrial and mining pollution problems. Money to the Public Health Service for building a water pollution laboratory at Cincinnati.

The reports to be released next spring are parts of a comprehensive report on the stream pollution problem in all the major drainage basins of the country. State pollution experts are already turning in preliminary reports to the ten basin headquarters of the division of water pollution control. These offices in turn will relay the information to Washington for drawing up the master report.

In most areas where mining is done, it is considered by Federal officials to be one of the important contributors to stream pollution.

State pollution agencies are using their new Federal money to step up their own anti-pollution programs. The grants this year range from $35,000 to New York to $8,758 for Nevada. In reporting projects on which they plan to use this Federal money, these states reported mining problems specifically: West Virginia,

Maryland, Missouri, Kansas, Kentucky, and Pennsylvania.

Wisconsin is devoting its grant to the codification of uniform standards of pollution. It is the kind of project that could be used as the basis for measuring the pollutive effect of any industry's or community's discharges.

Thus far industry has heard very little about the effect of the Federal Government's entry into stream pollution field on a broad scale. From here on, it is clear that sportsmen, public health officials, conservationists, and others will make extensive use of the information being gathered to get more Federal action against industrial stream pollution.

Anti-pollution groups aren't always working against industry, however. Recently the conservationists and recreation associations got together in Washington with officials of a number of industries that have long been attacked for polluting waters. All came out strongly in favor of bills already before Congress which would authorize amortization of industrial waste treatment plants in five years.

Those attending the meeting agreed that such bills by giving incentives to industry, provide the best and fairest means for speeding construction of treatment facilities by industrial and mining firms.

Chances for quick consideration of these bills depend on the action Congress takes toward passing a new general tax bill. The Ways and Means Committee of the House will indicate, early in the session, whether or not hearings will be held on the quick-amortization bills.

Although it now seems unlikely that any measure of this sort can be passed before Congress goes home for next fall's elections, the publicity generated by the Public Health Service's activities will promote general realization that industry needs help in meeting its pollution problems.

Lesson For Investors In Liberia Co.'s Slump

Development of backward countries, as President Truman outlined it some months back, is no game for amateurs. That hard lesson was brought home to Edward R. Stettinius, former secretary of state, just before he died. His Liberia Co., planned as a magnificent project to develop the natural resources of Liberia, is now dormant, its great plans shelved.

With a million dollars to start with, Stettinius saw his company as the model of a means of getting private U. S. capital to work abroad. He painted glowing pictures of Liberia's resources in iron ore, diamonds, gold, palm oil, and cocoa. He hoped to attract another $10,000,000 over the next ten years.

He raised the hopes of the Liberians with talk of power projects, railroads, highways, and sanitation facilities. These were to be financed both by his own efforts and with the help of the Export-Import bank.

Today, despite the best of effort and of intentions on Stettinius' part, about the only assets left to show for the two years' work are a cocoa plantation and a minority interest in a cold-storage plant in Monrovia, Liberia's capital. The 200-acre plantation was planted by the U. S. Government, and it may begin bearing in another five years.

Stettinius' first pitfall lay in overestimating Liberia's potentialities. In April, 1948, he said that engineering surveys had revealed resources in Liberia greater even than the most optimistic guess. He seemed to depend largely on his enthusiasm to raise funds, for when prospective investors asked for definite data, on the potential reserves of oil, for example, there wasn't much to offer. Current geological opinion, furthermore, is that Liberia has no important reserves of oil.

Stettinius did have something to talk about when it came to iron ore. Lansdell K. Christie, president of Liberia Mining Co., had already spent upwards of a million dollars surveying the iron-bearing Bomi Hills, 50 miles northwest of Monrovia. In this effort he was helped by the records of earlier Dutch explorations, which the U. S. got hold of in 1944. Christie's calculations showed reserves of 20,000,000 tons of high-grade iron ore in the Bomi region.

Christie needed more capital; the Export-Import Bank thought his venture a good risk, provided he could get private investors to take half the burden. So Christie let the Liberia Co. buy into his operation for $250,000, provided Stettinius could scrape up the needed capital.

Liberia Co. couldn't deliver when the time came. Christie finally got the money from Republic Steel, which now owns a big share in Liberia Mining. That satisfied the Export-Import Bank, which came in with a loan of $3,000,000. The loan, with another $4,000,000 or so, largely from Republic Steel, will be used to build bridges and a railroad from Monrovia up to the mining site.

Christie plans to mine the ore by open-pit methods, and hopes to be shipping more than 1,000,000 tons of 70% ore a year from his concession by the spring of 1951. He claims he can lay this ore down in Youngstown, Ohio, cheaper than any other imported ore, cheaper even than the Mesabi ores.

Apparently, one of the Liberia Co.'s chief troubles lay in unfamiliarity of those in top management with the country and its customs. The idea was all right, but the realities of investment abroad were too much for it. Based on the Liberia Co.'s experience, a primer for investment abroad would say:

1. Don't try to reform a whole country in one fell swoop. Stettinius might indeed have used his $1,000,000 to set up a pilot palm oil or cocoa plantation that would have set the pattern for the natives. True, such an investment would have yielded modest returns, but it might have been the entering wedge into the British West African monopoly on the palm oil and cocoa trade.

2. Hire experts to manage your foreign investments. No American knows Liberia better than Firestone's technicians. They built up Firestone's rubber operations in Liberia over the last 23 years, yet as far as is known, the Liberia Co. never consulted Firestone on its grand entry into the country.

3. You can't attract private investment with dreams and enthusiasm; not any more, and certainly not legally. Businessmen want proof, and the farther away from the U. S. the job is, the more proof they want. The Farrell Lines, an old Liberia operator, turned Stettinius down for this very reason. Farrell would back any sound scheme for the development of the West African coast, because their own shipping business would gain accordingly. Yet they wanted no part of the Liberia Co.'s big plans.

Mine-Mill Ouster Seen For Late in January

Final action by the CIO against the Communist-dominated Mine, Mill and Smelter Workers union may come at the CIO Executive Board meeting late in January. In two preliminary steps, the CIO has:

1. Notified Mine, Mill on Dec. 16 that it was behind in payment of per capita taxes for October and November. CIO President Philip Murray shot this notice to Mine, Mill the day after the tax was due, a promptness that suggests that he means business.

2. Scheduled a trial for Jan. 4 on charges that Mine, Mill's president, John Clark, and his union are following the Communist party line. If held to be true, this means that Clark could be denied a seat on the CIO Executive Board. The union could be expelled from the CIO and its charter withdrawn or given to another CIO union.

Mine, Mill paid $16,000 of its bill for per-capita taxes last October, but has paid nothing since. The union probably owes somewhere near $50,000 by this time.

There seems to be a concerted plan among the several left-wing members of the CIO, like Mine, Mill, to hold up the per-capita tax until they learn their fate. Lined up with Mine, Mill in non-payment are such groups as the Office Workers, the Food Workers, the Public Workers, the Furniture union, and Harry Bridges' longshoremen.

OPERATING IDEAS

Distilled Water Container

Thomas Trask, of the electrical department of the Magma Copper Co. mine, Superior, Ariz., designed this unique distilled water container which is used to service underground locomotive batteries. The bag consists of an ordinary 6:00x 16:00 inner tube with a grommeted canvas cover secured with rope lacing to allow easy removal of the tube for repair of a possible puncture.

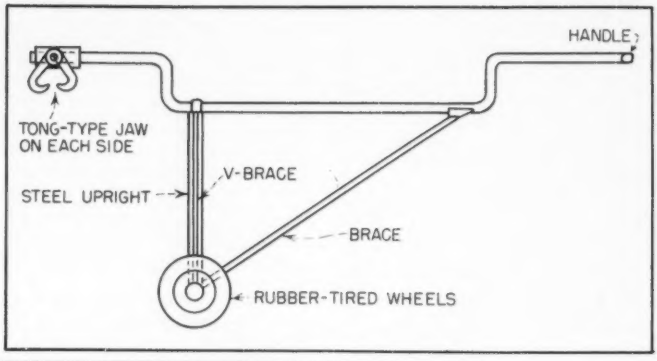
Two additional valve stems with inserts removed are vulcanized to the outer rim of the tube. One of these is used to fill the bag and for drainage to the batteries by means of a rubber tube with conventional filler head. The other valve stem is used for bleeding air while the bag is being filled. The valve stems are stoppered with regular valve caps.

These bags, one for each underground battery station, are brought to the surface when empty and filled at the surface boiler plant. Capacity is 7 to 10 gal. Weight varies from 60 to 90 lb., depending upon entry pressure and restrictive capacity of the canvas cover.

Advantages of this bag over the previous copper milk-can type of container used are: cheaper maintenance, easier transportation, and freedom from contamination by dust. Fred Crosby of the Magma company submits this description and illustration.

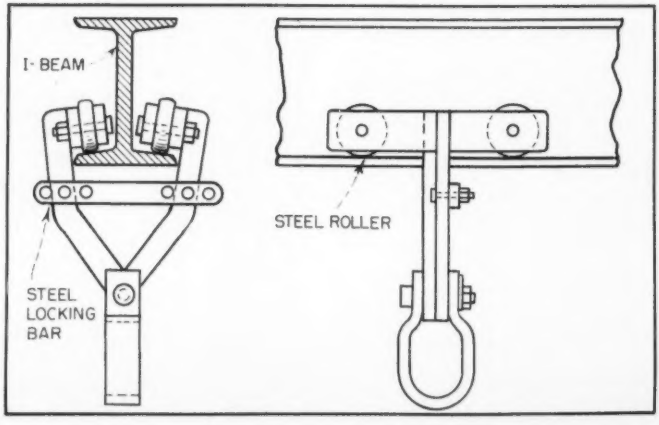
Handy Shop Dolly

Car and truck wheels, motor armatures, and other equipment can be handled quickly and easily with the simple dolly shown here. It consists of two wheels mounted on an axle, a steel upright or post with steel V-brace, a steel boom unit supporting tong-type jaws on the front end for lifting, and a steel handle at the rear end. The assembly is about 5½ ft. long and 32 in. high, with an 8-in. offset in the center to clear the skirt and underframe of a car. Construction is all welded.



Trolley Hook for Small Hoist

Maintenance and repair men at mines, mills and smelters will find this simple trolley hook a valuable shop auxiliary. The unit travels along horizontal I-beams. A hoist suspended from the hook can be moved about and to the side of a piece of equipment under repair. Rollers are at an angle to conform to the average taper for beams of different sizes. The locking bar has six mounting holes which permit the device to be locked in position on various flange widths. All parts were made from scrap material, and welded.



EXIDE-IRONCLAD PLATES *are DIFFERENT*

Enlarged cutaway view of section of tube containing active material. So small are the slots that, while permitting easy access of electrolyte, they retard the active material from readily washing out or jarring loose.

The famous and exclusive Exide-Ironclad positive plate is the result of sixty-two years of battery-building experience. During that time we have learned much about the design and construction of every type of battery for every application. Development work never ceases in improving the performance of Exide-Ironclad Batteries. Our research staff is the largest in the industry. Engineers, chemists, metallurgists, physicists, technicians and their aides, equipped with all the necessary tools and devices, are constantly building and testing various types and kinds of plates and assemblies.

We have yet to find a positive plate with all the desirable characteristics of the Exide-Ironclad for use in mine locomotives, trammers and shuttle cars. Further proof of its superiority is supplied by long service records in thousands upon thousands of installations.

Exide-Ironclad Batteries provide high power ability, high electrical efficiency, ruggedness, long life, minimum maintenance. The combination of these Exide-Ironclad characteristics assures years of dependable day-in, day-out service . . . *at lowest cost.*

THE ELECTRIC STORAGE BATTERY CO.
Philadelphia 32
Exide Batteries of Canada, Limited, Toronto

1888 . . . DEPENDABLE BATTERIES FOR 62 YEARS . . . 1950

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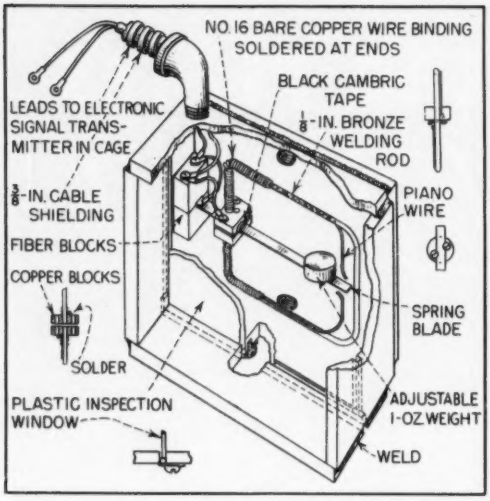


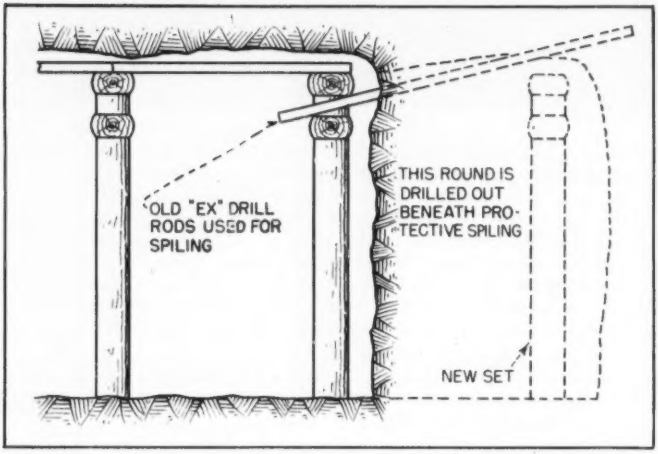
"Crash Switch" for Mine Cages

Fred Crosby of Magma Copper Co., Superior, Ariz., submits this illustrated description of an inertia-operated "crash switch" mounted in mine cages to indicate sudden stoppage of the cage. It operates through the electronic signal system used in Magma shafts. Sensitivity can be adjusted to indicate minor shocks such as those produced when the cage is set heavily on the landing chairs, or when it hits minor obstructions in the shaft. Thomas Trask, assistant chief electrician at Magma, developed the switch.

If a cage is stopped unexpectedly, this unit notifies the hoisting man to stop the hoist at once, and prevents the piling up of cable on top of the cage. Such inadvertent piling of hoisting cable is a major cause of dangerous rope kinks.

"During seven years' service," Mr. Crosby writes, "these switches have been actuated many times by various shaft obstructions, and have undoubtedly saved several cables from severe damage."

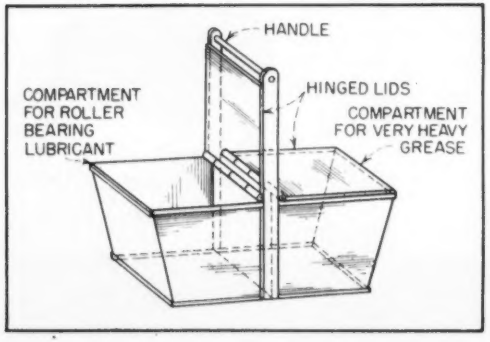
Old Diamond-Drill Rods Used for Spiling



Old "EX" diamond-drill rods can be used for spiling ahead of timber in bad ground, as shown in the accompanying sketch. The method is used in a large underground copper mine where blasting is done close to timber, and miners require protection while advancing.

Slanting holes, large enough to accommodate 1-13/16-in. rods, are drilled ahead of timber with light rock drills as shown. Then several lengths of diamond-drill rod are inserted to form a protective covering under which miners can muck out, and set up a new set of timber.

This method offers two advantages: 1. Drill rods, ready for discard, can be employed usefully. 2. Manual labor of driving spiling, as required in most conventional spiling methods, is eliminated.



Twin Lubricant Container

Truck servicing shops at open-pit mines will find the lubricant container shown a valuable addition to the available lubricating equipment. Modern practice in repacking truck wheels calls for extra heavy grease to fill the wheel hub, with lighter lubricant to spread on the roller bearings. In order to expedite this work and obviate carrying around two separate containers, a container divided into two compartments for the two different lubricants will be found useful. The unit can be made cheaply from scrap materials available at any mine repair shop.

STEEL...

for Every Mining Need

Shipped Quickly from Ryerson Stocks

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How to Align Herringbone Gears

Widespread use of herringbone gears in mining machinery requires mine mechanics to know how to handle the lubrication and alignment problems involved in these installations. The noise factor can be especially aggravating where the load and speed vary over a wide range as in balanced hoisting. Hence it is important that mechanics observe a few simple precautions outlined here by Paul Ziemke of Oak Ridge, Tenn.

How to Check Alignment

Noisy herringbone gears can be silenced by using heavy or "doped" lubricants. But this may be completely inadvisable if the lubricant is not of the "EP" (extreme pressure) variety needed for special cut gears. In addition to selecting the proper lubricant, the mechanic should check gears for alignment according to the following method:

1. Remove all lubricant from the lower case and gears, and scrub thoroughly with a degreasing agent.

2. Start two lengths of ordinary "string" solder (minus the acid and resin core) through the gears at the outer edges.

3. Retrieve the flattened sections with a minimum of handling.

4. Use a micrometer to read the tooth clearance indicated by these flattened strands.

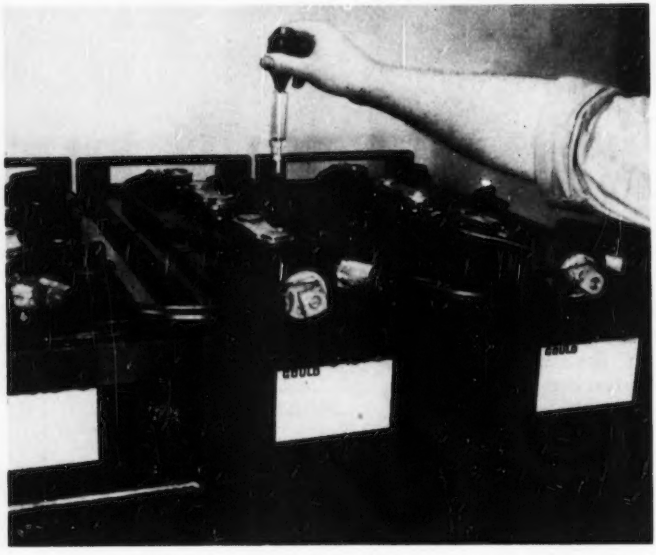
5. Proceed across the face of the gear at 1-in. intervals, and log the results carefully to develop a chart indicating the variation of tooth clearance for the full contact area.

How to Align the Gears

Some experts can adjust alignment neatly by loosening bolts on the pillow block mounting and shifting the pinion position by striking the block with a sledge. This can be done with a measure of success for the inward motion, but it is definitely not so simple to shift the heavy bearing base outward by the same technique.

It would be better to install welded-on posts of rectangular material on the bedplate through which four ⅝-in. threaded bolts are run through tapped holes to meet the pillow block at the corners. By this method, almost microscopic adjustment can be achieved in both directions for perfect alignment and quiet operation for all speeds required.

If noises persist after perfect alignment, especially on hoists in balance, these are the probable causes: Undue stresses set up in the driven gear set up by unequal tightening of the hub bolts; improper fitting of the cast drum quadrants on the drum spiders; or loosening of the hub bolts on the drum spiders.



Photograph, courtesy of Gould Storage Battery Co., Trenton, N. J.

HYDROMETER readings should always be corrected for temperature variations.

Examples of Temperature Corrections

Hydrometer Reading	Thermometer Reading	Correction	True SP. Gr.
1.250	87 deg. F.	plus 3	1.253
1.210	80 deg. F.	plus 1	1.211
1.180	64 deg. F.	minus 4	1.176

Battery Maintenance Requires Hydrometer and Thermometer

Two important tools in the battery room are the hydrometer and the thermometer. They indicate the state of charge of the battery and tell whether it is ready to do a day's work. Temperature readings are as important as hydrometer readings to determine the *true* specific gravity of the battery fluid, because specific gravity readings must be corrected on the basis of plus or minus three points of gravity for each 10-deg. F. (electrolyte temperature). Using 77 deg. as a base, three points of gravity are added for each 10 deg. above base, and three points subtracted for each 10 deg. below base.

This correction is necessary because the acid expands as its temperature rises. Hence it is not as dense, and the hydrometer float rides low. Conversely, when the acid is cold the float rides high.

Examples in the accompanying table show how the correction factor is applied.

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This new line of spring mounted Rear-Dump Euclids is designed for greater speed and stability on the haul road and long life in off-the-highway service. Heavy leaf springs are free floating in spring brackets to assure smooth riding and prevent breakage caused by twisting action on rough roads. Axles are positioned to the frame by longitudinal radius rods.

Rear-Dump Euclids with spring mounted drive axles range in capacity from 15 to 34 tons . . . diesel engines to 380 horsepower . . . and have travel speeds up to 32.2 m.p.h. Hydraulic booster steering assures positive control over all road conditions and reduces driver effort on sharp turns and rough hauls.

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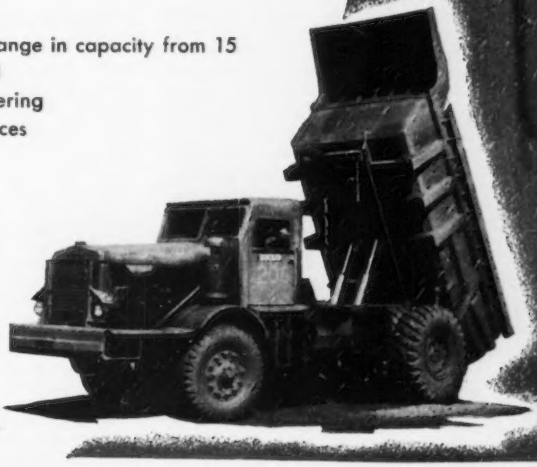

The EUCLID ROAD MACHINERY Co.
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PERSONAL NEWS

Charles Simon, treasurer of National Lead Co., was honored on Nov. 28 at a luncheon given by the board of directors in observance of his 45th anniversary of service with the company. Mr. Simon started as an office boy with the company in 1904. He became transfer clerk four years later, and in 1915 was appointed assistant treasurer of the company. Ten years later he was made treasurer.

James P. Margeson, Jr., executive vice president of International Minerals & Chemical Corp., has been elected a director of the corporation.

WILLIAM H. HOOVER, vice president and general counsel of Anaconda Copper Mining Co. and a director, was elected president of the company at a meeting of the board of directors on Nov. 29, 1949. He succeeds the late J. R. Hobbins. A native of Lodi, Ohio, Mr. Hoover was graduated from Wooster University, Ohio, in 1909, and from Harvard University Law School in 1913. He became associated with Anaconda in 1914 as associate counsel for the company's plant at Great Falls, Mont. In 1936 he was made western general counsel and in 1942 general counsel. Mr. Hoover, who is a resident of Butte, Mont., is also a director of the American Brass Co., Anaconda Wire & Cable Co., Chile Exploration Co., Andes Copper Mining Co., Greene Cananea Copper Co., International Smelting & Refining Co., and other affiliates of the Anaconda Company.

O. A. Sundness, Duluth, manager of range mines for the Snyder Mining Co., was elected chairman of the Lake Superior section of the American Chemical Society at a meeting in Hibbing on Nov. 12. **Ole Forsberg**, of Hibbing, is retiring chairman.

William E. Bertholf, Jr., Ishpeming, who has been assistant geologist for the Cleveland-Cliffs Iron Co., has resigned.

Oscar L. Chapman, who succeeds **J. A. Krug** as Secretary of the Interior, took oath of office on Dec. 1, 1949. At that time he conferred upon Mr. Krug the Department's Distinguished Service Medal, and citation, which emphasized former Secretary Krug's distinctive contribution to the Department's programs for the conservation and development of the country's natural resources.

Dr. J. K. Gustafson, member of the Atomic Energy Commission Raw Materials Division; **Thorold Field** and **Robert Macdonald**, technical advisors, and **A. A. Wells**, special assistant to the Commission's general council, are in Johannesburg, South Africa, to discuss uranium production with the South African Atomic Board.

H. C. Petersen, superintendent of land and exploration for Freeport Sulphur Co., has been appointed manager of the new division of the company to carry on a program of exploration and development in the oil and gas field. His headquarters will be in New Orleans. A graduate of the Minnesota School of Mines, Mr. Peterson joined the Freeport organization in 1934 at its Grande Ecaille sulphur mine. **Wayne Bowman**, consulting petroleum geologist, will be in charge of the new division's Houston office.

F. I. Bristol, **F. W. Libbey** and **S. H. Willisten** have been elected Oregon members of the board of governors of the western division of the American Mining Congress.

E. W. Beddow, chief clerk at the Douglas smelter operation of Phelps Dodge Corp., has retired after nearly 41 years with the company and the former Calumet and Arizona company.

Thomas J. Caulfield, general master mechanic at Kennecott Copper Corp.'s Utah mine at Bingham, retired Dec. 2 after 44 years of service with the organization.

W. R. Storms, supervising engineer of the U. S. Bureau of Mines at Silver City, N. Mex., and in charge of all mining division work of the Bureau in the State, has been transferred to Tucson, Ariz., to replace **J. H. Hedges**, chief of the Tucson branch. Mr. Hedges has been transferred to Washington to head the newly-created minerals division. **W. D. McMillan**, who has been with the Bureau at Austin, Tex., succeeds Mr. Storms.

Carlos A. Hieber, mining engineer, has been appointed acting director of the Bureau of Safety for the Montana State Industrial Accident Board. He was formerly an inspector for that division and has had extensive experience in mine and industrial safety work.

E. R. Ramsey, president of The Dorr Company, has returned from a six weeks' trip to Europe during which he visited the company's associated organizations in London, Paris, Brussels and Amsterdam. He also made a tour of various installations of the company in Great Britain and the Continent. **Arthur Terry, Jr.**, vice president in charge of European administration, accompanied him.

Louis Ware, president and director of International Minerals & Chemical Corp., resigned as a member of the board of directors of U. S. Gypsum Co., on Nov. 9.

J. P. DeWet, secretary of the Manitoba Chamber of Mining, Winnipeg, and editor of *The Precambrian*, recently spent some time in New York.

CLYDE E. WEED, vice president in charge of mining operations of Anaconda Copper Mining Co. for the past seven years, was elected a director of the company on Nov. 29. After graduation from Michigan College of Mines & Technology in 1910, he gained early experience in the copper mines of Michigan, after which he held engineering supervisory positions at copper mines in Arizona and Mexico. Prior to joining Anaconda in 1938 as general manager of mines, Mr. Weed was president and general manager of the Cananea Consolidated Copper Co. He is a director of Andes Copper Mining Co., Chile Copper Co., Chile Exploration Co. and International Smelting & Refining Co. He is also vice president and director of Greene Cananea Copper Co. and a director of the American Institute of Mining & Metallurgical Engineers.

R. S. Archibald, president of North Range Mining Co. and **Endicott R. Lovell**, president of Calumet & Hecla Consolidated Copper Co., are now directors of the recently organized Duluth, South Shore & Atlantic Railroad Co.

Arthur W. Tews, Duluth, was elect-

ed president of the Eighth District Minnesota Association of Professional Engineers at a meeting held in Eveleth in late November. **C. R. Knowles**, Hibbing, was elected first vice president; **Gordon H. Butler**, Duluth, second vice president; **L. L. McGladrey**, Cloquet, secretary, and **R. M. Moyle**, Hibbing, treasurer.

Changes in personnel on the Gogebic range announced for Pickands, Mather & Co., by **W. A. Knoll**, Ironwood, general superintendent, are as follows: **A. Larry Johnson**, assistant superintendent at the Cary mine, Montreal, Wis., is now superintendent at that property. **Roy R. Smith** is head mining captain at the Cary mine. **Harold L. Shiebler**, superintendent at the Cary mine, is now in charge of the Newport mine, east of Ironwood and the Ironton, near Bessemer. **Russell L. Jose** is assistant superintendent at the Ironton.

Charles Rule, mine superintendent of the 400-year old mine of Potosi, for the past two and a half years, has been transferred and promoted to general manager of the Colquiri Unit, second largest tin producer of the Mauricio Hochschild group of mines.

Fremont E. Wood has resigned his position as mechanical-electrical superintendent for the Mexican mining department of American Smelting & Refining Co., to become mechanical-electrical superintendent with the Cyprus Mines Corp., on the Island of Cyprus.

E. J. Matson, of Reno, was awarded $100 and a certificate of honorable mention by the U. S. Bureau of Mines for a suggestion for a mechanical sludge sampler. The device, for use in obtaining fractional samples of sludge from diamond drill holes, was adopted by the Bureau. The presentation of the award was made at the mining branch office in Reno by **A. C. Johnson**, chief.

Philip W. Chase, Duluth, manager of special explorations for the Oliver Iron Mining Co., has recently returned from a trip to Africa.

Axel E. Johnson has been appointed claim agent for the Lake Superior subsidiaries of the U. S. Steel Corp., with headquarters in Duluth. He succeeds **Otto L. Manthey**, who retired on Nov. 1.

Howard I. Young, president of American Zinc, Lead & Smelting Co., was reelected president of the American Mining Congress on Dec. 7, at the organization's annual business meeting in New York. Mr. Young has held this position for the past 17 years. He is a past president of the American Zinc Institute. During World War II he served as director of the War Production Board's Minerals Division. **Andrew Fletcher**, president, St. Joseph Lead Co., and **Donald A. Callahan**, president Callahan Consolidated Mines, Inc., were reelected as vice presidents. **W. J. Jenkins**, president of the Consolidated Coal Co. of St. Louis, was also elected vice president to succeed **James D. Francis**, chairman of the board, Island Creek Coal Co. **Julian D. Conover** was reelected secretary. The following were elected to the board of directors: **V. P. Geffine**, Cleveland-Cliffs Iron Co.; **W. H. Hoover**, Anaconda Copper Mining Co.; **Neil W. Rice**, U. S. Smelting, Refining & Mining Co.; **J. T. Ryan**, Mine Safety Appliances Co.; **Merrill E. Shoup**, Golden Cycle Corp.; **L. R. Kelce**, Sinclair Coal Co.; Mr. Young, and **Raymond E. Salvati**, Island Creek Coal Co.

THREE GENERATIONS OF THE MUFFICH FAMILY are shown on the fiftieth anniversary of the steady employment of John Muffich, Sr. (right) in the East Helena smelter of American Smelting & Refining Co. On Oct. 3, he was presented with an engraved gold watch in commemoration of his employment with the company, by Kuno Doerr, Jr., manager of the East Helena smelter. Shown with him are his father, Nick Muffich (center), who retired in 1919 after 28 years with the company, and his son, John, Jr. (left), who completed 26 years of continuous service on April 18, 1949. The combined service of the three members of the Muffich family totals 104 years.

Roland S. Young has resigned as chief research chemist to Rhokana, Nchanga and Broken Hill companies of Northern Rhodesia to become director of the Diamond Research Laboratory in Johannesburg. Dr. Young will still retain close contact with base metal industry through his association with the Anglo American Corporation of South Africa.

Hewitt Wilson, technologist and administrative head of the Norris, Tenn., station of the U. S. Bureau of Mines since 1938, has been appointed regional director of Region VII. He succeeds **J. Bruce Clemmer**, who served as regional director with headquarters at Tuscaloosa, Ala., for a short time. The headquarters have been transferred to Norris. Mr. Clemmer is returning to Tucson, Ariz., where he is engaged in metallurgical research.

Martin Butler Gentry, mining engineer and vice president of Freeport Sulphur Co., was recently named vice-president and a member of the executive committee of the American Arbitration Association. He is also vice president of the Sulphur Export Corp. Prior to 1935 he served as mining engineer and general representative for **William Braden** and the Anaconda Mining Co. in Chile and other South American countries.

H. K. Lange, publicity director for the Vermiculite Institute, has resigned, following his retirement from active service. Associated with the vermiculite industry since 1934, and the Institute since 1945, he has directed the preparation of many articles dealing with the uses of vermiculite in construction and other fields. **L. A. Castell**, assistant to Mr. Lange since 1943, succeeds him.

Roy A. Hardy, consulting engineer in charge, Getchell Mine, Inc., Reno, Nev., has been named chairman of the program committee for the 1950 Metal Mining Convention and Exposition of the American Mining Congress to be held in Salt Lake City, Aug. 28-31, 1950.

J. W. Woomer, of J. W. Woomer & Associates, consulting mining engineers of Pittsburgh, Pa., and Wheeling, W. Va., has recently returned from a trip to Australia. While there he made an inspection of the steel company mines in Eastern Australia and also examined the virgin coal available in Western Australia for the construction of a steel plant in that state.

Prof. Fred B. Seely, of the University of Illinois, was honored recently by the American Society of Mechanical Engineers when he received the Worcester Reed Warner medal given for outstanding contributions to permanent engineering literature.

O. A. Rockwell, mining manager of the Calumet division, Calumet & Hecla Consolidated Copper Co., has

been named assistant general manager of the division. His appointment became effective on Jan. 1. **A. H. Wohlrab**, vice president and general manager of the division made the announcement.

R. EWART STAVERT, president of The Consolidated Mining & Smelting Company of Canada, Ltd., was recently elected a director of The International Nickel Company of Canada, Ltd., according to an announcement by Robert C. Stanley, chairman of the board of directors. Mr. Stavert, who resides in Montreal, joined the Consolidated Mining and Smelting company in 1934 as assistant to the president. He was appointed vice president in Montreal in 1939 and elected vice president of the company in 1941. He has been president since April, 1945. Mr. Stavert also holds directorships in various other Canadian companies.

OBITUARIES

Stuart St. Clair Bruce, retired mining engineer, died Nov. 10 in Berkeley, Calif. He was 70. Mr. Bruce came to the United States from Dublin, Ireland, in 1893. After graduation from the Colorado School of Mines, he taught metallurgy at Michigan College of Mines and the Idaho School of Mines and was associated with several midwestern mining concerns.

Walter William Stoll, 61, president and general manager of the Alaska Pacific Consolidated Mining companies, died Nov. 13 at Seattle. He entered the mining business in 1935 and discovered and developed the Independence mine, which under his management, became the largest lode gold producer in the territory.

Roy E. Thomas, 55, mining and metallurgical engineer with Anaconda Copper Mining Co., died in Denver, Colo., in November. At the time of his death he was assistant to the chief engineer of the company, having formerly served the company in South America and Poland.

William F. McNair, former well-known Goldfield, Nev., miner, died Nov. 12 in Las Vegas after a lingering illness. He served for several years as local superintendent of the Goldfield Consolidated mines.

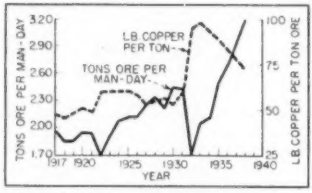
G. T. Salzman, former mining engineer, died Nov. 18 in Virginia City, Nev. He was 67. He had worked as a mining engineer in different sections of the State until four years ago when he moved to Virginia City to take over the Silver Stope gift shop.

Richard LeRoy Oliver, 65, died in Lansing, Mich., on Nov. 12. He was a former resident of the Copper Country where he was superintendent of the Calumet & Hecla stamp mill at Point Mills.

At the annual general meeting of Placer Development Limited, held in Vancouver on Nov. 21, **Charles A. Banks**, managing director, who presided, referred to the recent death of **Frank R. Short** as follows:

"I much regret to advise you that **Frank R. Short**, who had been ill for some time past, died on Nov. 4. Mr. Short was an outstanding mining engineer who had largely specialized in gold alluvial operations, and who was well known throughout the mining world. He joined the board of this company as a technical director over 20 years ago, since when his services have been invaluable to this company and its subsidiary operations, notably Bulolo Gold Dredging Limited and Pato Consolidated Gold Dredging Limited. Mr. Short had a most lovable personality and his loss is keenly felt by all the directors."

LETTERS



PRODUCTIVITY rose in 1932, said P. Malozemoff recently. Graph shows why . . .

Mr. Maury Disagrees . . .

To the Editor:

I avail myself of your invitation to discuss Mr. Malozemoff's splendid article on the "Real Danger of High Costs" in the November issue.

Certainly every thinking man will agree with Mr. Malozemoff's thesis that our mining industry is probably on the maturity plateau of the Pearl-Reed growth curve, from which it can begin new growth only by the institution of a completely new economic or technologic climate. It is with one of his corollary assumptions that I wish to take issue.

His Figure I charts productivity in several types of copper mines since 1917, in terms of pounds copper per man-day. Pounds of copper per man-day is an excellent index of the profitability of copper mines. When this financial ratio is carried over into considerations of labor efficiency, however, it falls short. A better index of labor efficiency is tons of ore per man-day.

Management must, of course, continually balance these two factors of profitability and efficiency. These day-to-day decisions determine, within the grade limits of each mine, the grade of ore extracted and the pounds of metal produced per man-day. The diligence of the laborer has only a fringe effect on the grade of ore which he is instructed to mine.

Turning to Mr. Malo[illegible]off's discussion, he attributes t[illegible]pper productivity of labor in [illegible] thirties largely to the gene[illegible]ngency of the economic atmosph[illegible]and the consequent willingness of the laborer to work hard to keep his job. This easy assumption is not in accord with the facts.

Taking Dr. Leong's data from 1917 through 1936, as did Mr. Malozemoff, and converting the latter's data for 1939, I have charted together the tons of ore per man-day and the grade of ore for the class "Other Underground Mines." As he says, these mines are the most sensitive to variations in labor efficiency.

Examining Mr. Malozemoff's assumption on labor efficiency in the early thirties in the light of my chart, the error is clear. In the early thirties, tons of ore productivity dropped precipitately. The reason is found in the sharp increase in grade of ore mined from 60 pounds per ton to almost 100. That is, selective mining was practiced to an extreme degree. Selective mining must orient its approaches and methods to the narrow, often discontinuous bodies in which high-grade ores are concentrated. It can employ only a minimum of systematic extraction and mechanical equipment. Try as a miner may to insure his job by due diligence, he will put less rock in the box.

As economic conditions improved in the late thirties, management was able to lower the average grade of ore mined, shift the emphasis of its operations toward mass-mining, and resume the technologic advances which flourish in large and continuous openings.

We cannot say whether continuation of technologic advance in these mines was facilitated by the elastic subsidy system used during the war years or by high prices through 1948, since clear data are not available after 1939. The Bureau of Mines would, I think, do a real service if it would bring Dr. Leong's series up to date and maintain it in the future.

Until we have such data, I do not think we can accept Mr. Malozemoff's opinions that labor efficiency has been at an all-time low during recent years and that management may have been lax in contemplation of wide profit margins. The case is not proven.

In recent months, metal prices have

been such that many underground mines may now be forced back to the selective practices of the early thirties. My friends in the industry will not be surprised when I suggest that for such mines, the climate necessary to new growth above the Pearl-Reed maturity plateau can be found in an elastic subsidy system, designed to facilitate mass-mining and thorough extraction of ores.

JESSE L. MAURY

Chevy Chase, Maryland

. . . Mr. Malozemoff Replies

Mr. Maury is calling attention to an element of costs that is as important as it is complex and difficult to analyze. There are so many factors, human, technological, managerial, organizational and others, which affect productivity of labor—the measure of its efficiency—that careful classification and qualification of the data and often special interpretation of the productivity indexes constructed from them are needed. In my article I was necessarily limited by my general subject to an all too brief and simple demonstration and discussion of the effect of productivity on costs. That is why I used the pounds copper per man-day as the index.

I will readily admit that this index is not a good measure of the efficiency of labor, i.e., a measure of a man's individual effort and skill, whether he is behind a muckstick, a mucking machine, or a power shovel. But neither is the ore productivity index, or the tons ore mined per man-day.

During periods of low prices and curtailed production, higher cut-off grade requires mining more selectively, usually in narrower stopes and with consequent lower ore productivity, yet efficiency and skill required and usually achieved under these conditions are higher than before.

This, no doubt, was partly responsible for the drop in ore productivity from 2.46 in 1931 to 1.79 tons ore per man-day in 1932. In some measure it was also due to the relatively much higher proportion of "unproductive" labor used in general and indirect services (e.g., maintenance, pumping, hoisting, etc.) in 1932 when production was curtailed drastically. Such "unproductive" labor is included in the Bureau of Mines labor statistics from which the productivity index was derived. Labor efficiency *per se* can thus be reliably measured only under controlled conditions, and general statistics such as the Bureau of Mines data do not serve well for this purpose. My conclusion that higher efficiency of labor obtained in the thirties, and that it greatly deteriorated in 1944-48, was not directly proven by the data I adduced, but it is supported by the great majority of mine managers who experienced at close range those difficult years.

P. MALOZEMOFF

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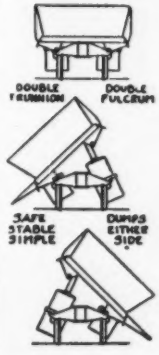

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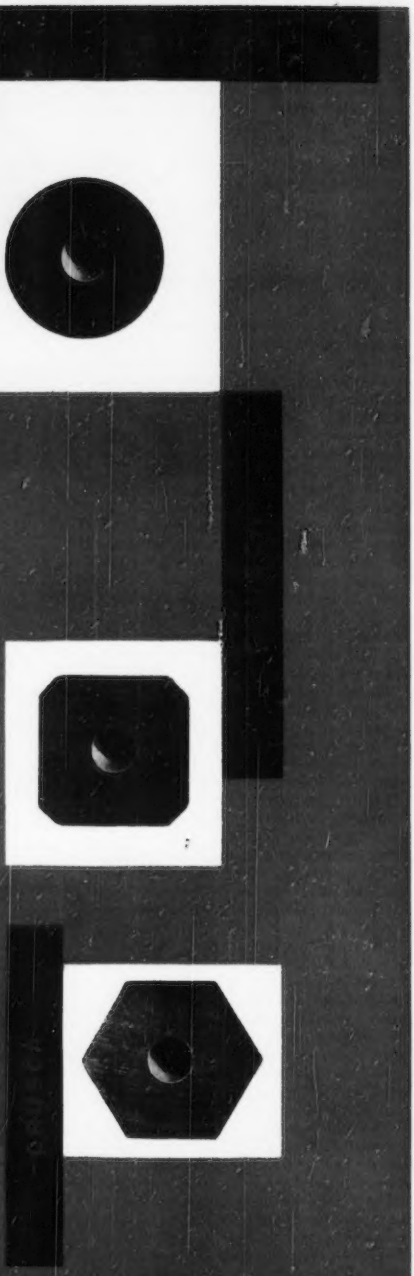

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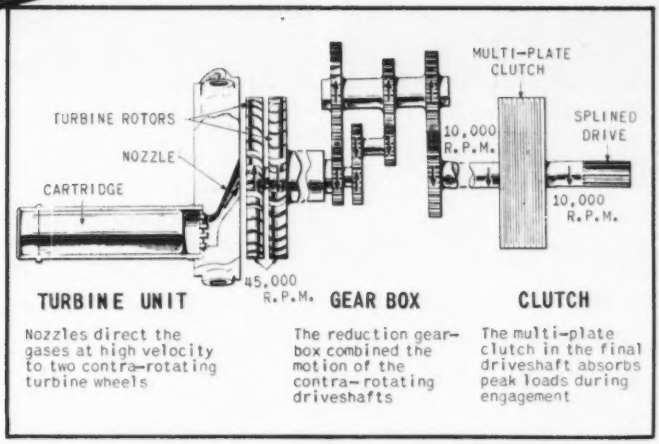
For further information on these products, circle item numbers on card—insert and mail.

PREVIEW



1. TURBINE STARTER employs auxiliary turbine and cordite cartridge to give high power output for bringing turbine up to starting speed rapidly.

Cordite Cartridge Starts Turbines Faster

Need for a light starter with a relatively long working period plus a high power output to crank a turbine engine to its starting speed in a reasonably short time has led to the development of cordite cartridge starter by the Plessey Co., Ltd. of England.

Consideration of starter requirements indicated use of a turbine type and the company's long experience with cordite directed them to its use. The combination produced the Turbine Starter Type T.S.C. 50.

The charge is contained in two percussion cap cartridges which are fired simultaneously through two nozzles at opposite sides of the rotor. The starter carries six cartridge barrels disposed in a circular cluster, this arrangement making for compactness with maximum thermal efficiency and balanced loading.

To reduce weight and overheating to a minimum, and in view of the extremely high velocities resulting from the high temperature cordite gases, a highly efficient contra-rotating turbine wheel system without the interposition of stator blades was designed to give maximum relative blade velocity. This permits a useful energy output to be obtained from the second stage wheel.

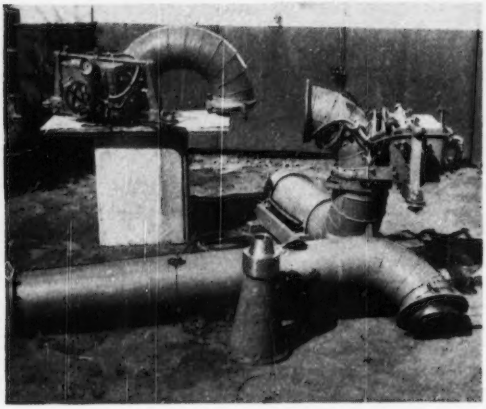
The drive from the rotors is taken through a triple combining and speed reducing gear train to the output stage which is provided with a splined drive. Peak speed of this shaft is 10,000 rpm., corresponding rotor speed being 40,000 rpm. A clutch is built into the drive to absorb peak loads during engagement, and to render the starter safe in the event of failure of any part of the drive an overspeed device limits rotor speed.

Lubrication of the bearings and gear trains is by a built-in pump which, at each start, meters the necessary small amount of oil from the main turbine engine.

Weight of the starter, complete with cartridges, is 50 lb. Maximum energy output is 50,000 ft. lb. over its working period.

EACH MONTH this page will feature a "preview" of a product not yet on the market, but coming your way soon. As alternatives, outstanding examples of cost-cutting by application of new equipment, or important developments in new products for mine, mill and smelter, will be offered.

2. AUTOMATIC GIANT strips perma-frost from large areas of gold-bearing gravel and keeps ground clean for follow-up mining operations. Units are light, easy to move.



"INTELLIGIANT" is easily disassembled. Motion is controlled by piston and cylinder arrangements for vertical and horizontal traverses. Both are independent in speed and stroke.

Automatic Giant Cuts Placer Mining Costs

"Intelligiant" solves placer problem by operating continuously without prohibitive labor costs, allowing better planning, more aid from natural conditions.

THE PROBLEM:

Placer miners in Alaska are faced with the problem of removing perma-frost to reach gold-bearing gravel in river beds, creek channels and high benches. The perma-frost is a permanently frozen top layer of earth up to 110 ft. or more in thickness.

Perma-frost is washed away by water shot from nozzles of hydraulic giants under pressure. The work must be done from June to August when heat from the sun thaws the frozen ground. Under these conditions, the high cost of labor creates several difficulties.

No mine owner can afford a large enough crew to manually operate the guns 24 hours per day to prepare and keep the ground clean for mining. Stripping costs are kept proportional to gold production to make a profit. Thus, thousands of yards of muck thawed ahead may freeze back in the fall because the operator could not afford a crew to keep the ground cleared. Or, if he strips a little and mines a little, he often does not strip far enough in advance of mining. Then the sun's heat hasn't time to thaw deeply enough to provide enough work to keep bulldozers and draglines busy. In either case varying weather conditions leave little margin for error.

Under present mining methods, flow of water is stopped at the end of a shift. Overnight, muck solidifies, even freezes, and work of making it fluid, has to again be done.

If the water is not kept in motion during the day, layers of perma-frost become hard and dry as the sun thaws, insulating layers underneath. When thawed material can be kept moving so that there is no pause to allow evaporation or settling, much less water is needed. Here again, high labor costs limit much essential washing, thus hindering production.

THE SOLUTION:

With the automatic giant or "Intelligiant," operators can make use of every degree of heat the sun puts out because the perma-frost is kept bare by continuous streams of water. One man can supervise as many as 10 or 12 guns and they keep the muck moving 24 hours a day.

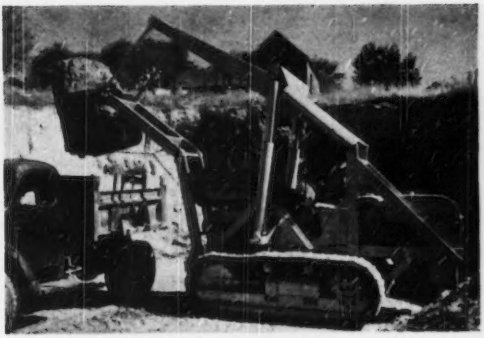
Operating pressure for the "Intelligiant" is from 15 to 75 psi. although each unit is tested for pressure up to 150 psi. Motion is controlled by two piston and cylinder arrangements, one for traverse and one for vertical. A regulated stream of water from the main flow through the nozzle actuates the cylinders. A reversing mechanism changes stroke direction. Speed of movement and length of traverse for both horizontal and vertical motions can be set independently so that any pattern can be traced by the stream of water from the nozzle.

The "Intelligiant" weighs about 125 lbs. or half the weight of the usual giant. It has the advantage in that the operator can move it from one location to another without dismantling it.

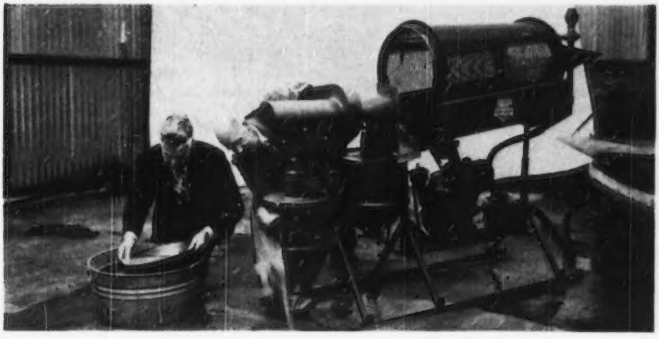
Each unit has two 15-lb. leak-proof bearings of full flow design which require lubrication with a zirk gun about once a month. This type of bearing eliminates internal obstructions which cause turbulence in the stream. This prevents leak-producing vibrations that would otherwise require the giant to be secured to a firm anchor or immovable base.

According to John Miscovish, the inventor, the "Intelligiant" will efficiently keep the gravel exposed to sun and rain for complete thawing. It will thus eliminate wear and tear on equipment and increase the yardage of pay dirt handled each season.

3. HEATING SYSTEM prevents ore from freezing to truck body in winter. Heat from exhaust enters truck lining where angle iron has replaced wood sandwich, through connecting pipe in the body. Euclid Road Machinery Co., Cleveland, Ohio.

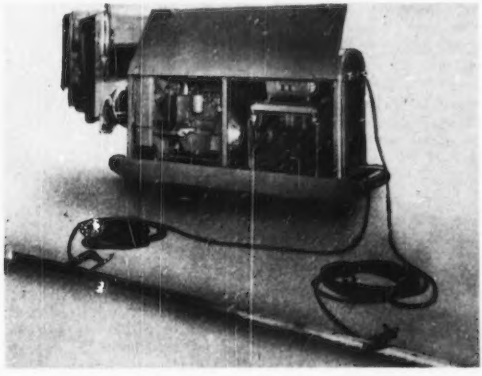


4. HYDRAULIC SHOVEL and loader is now available for all tractors. "Diggster" weighs 21,480 lb. Uses 1 and 1¼-cu. yd. digging buckets, 1½ and 2-cu. yd. buckets for loose material. Dempster Bros., Inc., Knoxville, Tenn.

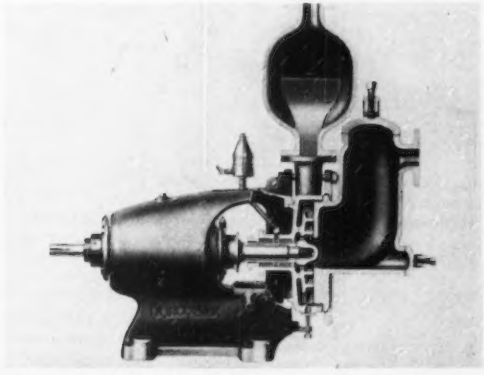


5. CONCENTRATOR requires neither centrifugal force nor amalgamation. Materials first screened under a water jet are conveyed to the bowl. Traveling through a revolving spiral, gold or other metal is carried to lowest point in the bowl. Unit capacity depends on number of bowls; this machine handles about 10 tons per hour. Taylor All-Metals Concentrator is made by Northwest Machine Works, Portland, Ore.

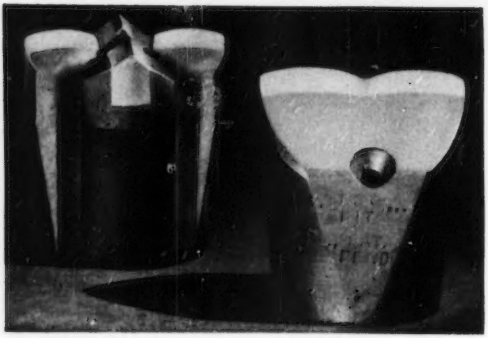
6. GEIGER COUNTER is unaffected by moisture. Small probe on 30-in. flexible cable permits exploration of crevices and small boreholes. Counter comes with earphones, web belt. Tracerlab, Boston, Mass.



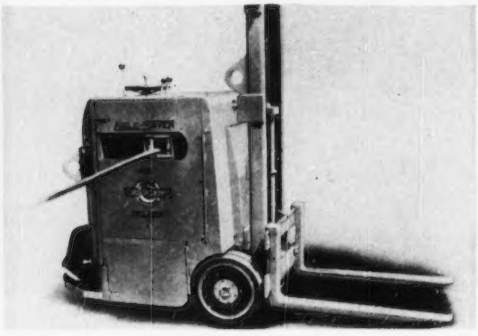
7. GENERATOR has only one moving part, a permanent magnet rotor. Skid-mounted, gasoline engine powered units are used for lighting, welding and thawing. Winding will carry three times rated output. Midwestern Engine & Equipment Co., Tulsa, Okla.



8. SELF-PRIMING PUMP is made in full range of corrosion-resisting alloys. Micro-adjustment of impeller position and renewable shaft sleeve are other features. Available: Duriron Co., Inc., Dayton 1, Ohio.



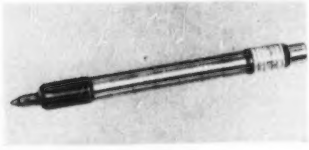
9. DRILL BITS have crowned tungsten-carbide inserts and self-cleaning chip channels. "Rok-Drill Bits" are the detachable type and available in sizes up to 4 in. dia. Made by Rock Bit Sales & Service Co., Philadelphia, Pa.



10. FORK TRUCK operates on compressed air for areas where explosion hazards exist. Uses 250 cfm. at 90 psi. Retracting reel with 75 ft. of hose allows movement in about 18,000 sq. ft. Crescent Truck Co., Lebanon, Pa.

EQUIPMENT SHORTS

29. PYROMETER is compact. Comes in 4 temperature ranges from 0-400 to 0-1200 deg. F. Uses rigid or flexible extension. Available: Pyrometer Instrument Co., Bergenfield, N. J.



30. COUNTER TUBE for beta and gamma ray detection has thin metal wall. Self-quenching tube, Type 52N, operates in wide temperature range. Available: Amprex Electronic Corp., Brooklyn, N. Y.

31. HEADLIGHT. Sealed-beam locomotive headlight, "Locolight," produces 19,000 candlepower, projects beam 500 ft. Headlight is easily serviced, using only a screwdriver. Available: **National Mine Service Co.**, Beckley, W. Va.

32. GEIGER COUNTER. "Keleket" "Prospector" weighs only 2 lb. Is powered by two flashlight batteries. Price (less headphone set): $45.00. Available: **Kelley-Koett Mfg. Co.**, Covington, Ky.

33. PROTECTIVE COATING. "Stoncote" is an acid-resistant coating of a plastic formula for floors, walls, machinery. Applied by brush or spray, it dries in less than one hour. Available: **Stonhard Co.**, Philadelphia, Pa.

34. TACHOMETER. Portable tachometer and cutmeter have accuracy of better than 0.5% of full scale in measuring surface or shaft speeds. Ranges from 0 to 5,000 fpm. or 0 to 25,000 rpm. Designed for continuous or intermittent use, no batteries are required. Available: **Electric Tachometer Corp.**, Philadelphia, Pa.

35. BLASTING. Split-second timing and blasting machine fires charges from a 110-v.a.c. supply. Instrument accommodates 20 firing circuits. Each is energized by a contact arm geared to a synchronous motor. Time interval is selective—from 20 to 28 milliseconds. As many as 40 detonators may be wired in series on one point. Available: **Laboratory Associates, Inc.**, Belmont, Mass.

36. TURNTABLE. A simply designed turntable of pressed steel to accommodate any gauge track comes in various diameters up to 120 in. Available: **Hardinge Co., Inc.**, York, Pa.

37. HAMMER MILL. Hammer-type mills have oversize dust collector, special finger feed roll to handle roughage and fibrous materials, and sectional hinged hood for easy screen change. Available: **Daffin Mfg. Co.**, Lancaster, Pa.

38. TIMER: Impulse timer has no clutch or gears to wear out. Different models for regulating electrical equipment can be set for 1½ second to 60 second minimum and maximum, intervals, up to 9 to 360 seconds minimum and maximum. Setting is made by easy adjustment. Price: $55.00. Available: **Zenith Electric Co.**, Chicago, Ill.

39. WOOD PRESERVATIVE. "Non-Tox," a new non-toxic wood preservative is claimed by the manufacturer to have exhibited unusual fungicidal effectiveness in recent tests. Application varies but dip treatment is most economical. Samples on request. Available: **Brooklyn Varnish Mfg. Co.**, Brooklyn, N. Y.

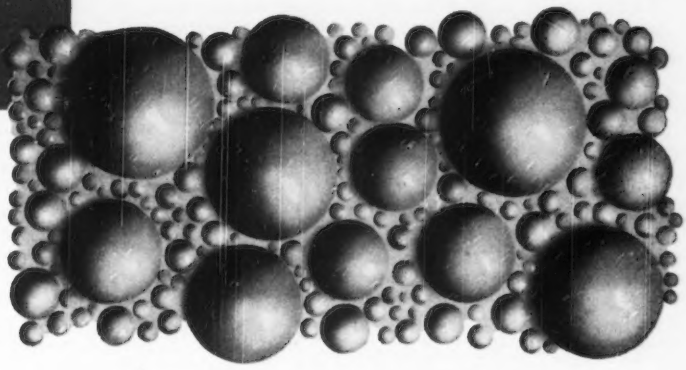
40. PLATFORM TRUCK. Battery-powered platform truck with load area of 20 sq. ft. is adaptable to less-than-carload freight handling and other special transportation applications around the plant. Truck is the Baker Hustler, Type PB 2000-lb. Available: **Baker-Raulang Co.**, Cleveland, Ohio.

41. BLASTING CAPS. A new line of Western Minimax electric blasting caps are designed for fractional-second delay blasting. Accurately timed caps of one-piece, all-metal construction are supplied in 10 periods of delay. Available: Explosives Div., **Olin Industries, Inc.**

42. PROTECTIVE COATING. "Paraline 18-8 stainless steel in solution" forms a protective film that resists attack by acids, alkalis and fumes, says the manufacturer. It is also claimed to be unaffected by aging, sunlight, petroleum hydrocarbons, salt water, oils and alcohols. Applied by brush, spray or dip, one gallon will cover about 450 sq. ft. with one coat. Available: **Barber-Webb, Inc.**, South Gate, Calif.

Dependable Bear Brand Xanthates

"Over Twenty-Five Years' Experience in Producing Xanthates for Metallurgical Use."



BEAR BRAND XANTHATES AVAILABLE

- **Z-3—Potassium Ethyl Xanthate**
- **Z-4—Sodium Ethyl Xanthate**
- **Z-5—Potassium Amyl Xanthate***
- **Z-6—Potassium Pentasol Amyl Xanthate***
- **Z-8—Potassium Sec.-Butyl Xanthate**
- **Z-9—Potassium Isopropyl Xanthate**

**From Sharples Amyl Alcohols*

Time and experience have demonstrated that for optimum results in the flotation treatment of substantially all sulphide ores, as well as some oxidized ores and ores containing native metals, Bear Brand Xanthates are the cheapest and most efficient collectors now available.

Great Western Division

THE DOW CHEMICAL COMPANY

San Francisco 4, Calif., U.S.A.

A. P. DEVITA is the newly appointed New York district sales manager for Robins Conveyors Div. of Hewitt-Robins, Inc.

GLEN G. REED will take over duties as manager of sales in the Chicago office of Oliver United Filters, Inc.

Memos from the Manufacturers

Minneapolis-Honeywell Regulator Co. has promoted **William W. Martenis** to manager of sales engineering.

Manhattan Rubber Div. of **Raybestos-Manhattan Inc.** now has the world's largest precision conveyor belt press in the world in operation at its Passaic, N. J., plant.

William C. Bruton has been named district sales manager for American Manganese Steel Div. of **American Brake Shoe Co.**

Kaiser Aluminum & Chemical Corp. is now the name of what formerly was **Permanente Metals Corp.**

Robert L. Frazer has been made Spokane representative of **Joy Manufacturing Co.**

D. S. MacDonald has been appointed assistant to the manager of gear motor sales **General Electric's** Small and Medium Motor Div.

A. M. Shaw has been promoted to assistant manager, Pump and Compressor Merchandising Div. of **Worthington Pump and Machinery Corp.**

Otto V. Norvig has been appointed sales engineer of Crusher and Process Machinery Divs. of **Nordberg Manufacturing Co.**

General Refractories Co. has transferred **Alan R. Eakins** to the New York warehouse sales force, and **Richard H. Lightfine** to the New York district sales office.

Elmer Carling is now assistant sales manager, Pigment Dept., **American Cyanamid Co.**

Electro Chemical Supply & Engineering Co., which has recently moved its offices to Emmaus, Pa., has named **H. D. Fowler Co.** of Seattle as agent in the Northwest.

Appointment of **Stuart Smith** as product manager, sheet and plate sales, has been announced by **Reynolds Metal Co.**

Colorado Iron Works Co. has elected **E. C. Bitzer** as executive vice president and general manager.

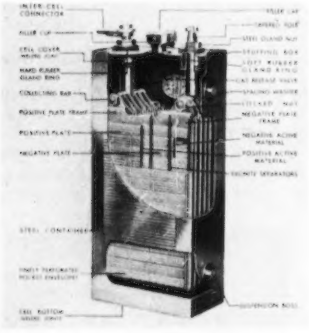
Laclede-Christy Co. has acquired the capital stock of **Diamond Fire Brick Co.** of Canon City, Colo.

Albert G. Crockett has been appointed manager of distributor sales for **Mack-International Motor Truck Corp.**

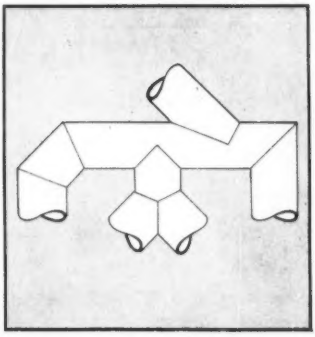
William J. McQuillan has been promoted to branch manager, Pittsburgh office, Morse Chain Co. Div. of **Borg-Warner Corp.**

Geo. P. Reintjes Co. has named **Interstate Sales Inc.** to represent it in the St. Louis area.

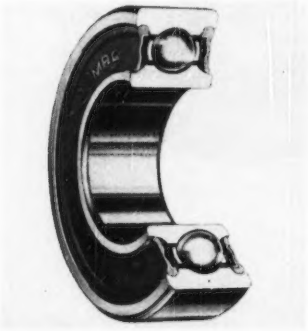
Arthur A. Leschen and **Douglas W. Vernon** have been elected president and vice-president-general-manager respectively, of **A. Leschen & Sons Rope Co.**



11. STORAGE BATTERY is made of steel throughout. Requires low charging current and capacity is not affected by high discharge. Nickel cadmium battery is made by Nife Inc., N. Y.



12. CONTOUR MARKER gets this layout work on pipe or structural steel done in five minutes. Instructions supplied with handy tools by Contour Marker Corp. of California, Compton, Cal.



13. BALL BEARING of standard dimensions has removable synthetic rubber seal for keeping out dirt and moisture. Available in popular sizes. Marlin-Rockwell Corp., Jamestown, N. Y.

DORRCO DOINGS IN 1949

1949 Again a year of uncertain progress. The definite advances made in Western Europe towards a united democratic government with a declaration of independence in another sector seem overbalanced by changes in Asia. In all they emphasize the conclusion that final peace must come from the heart, and when fear can be cast out, it will come.

At home the wave of enthusiasm brought by the sanity of the Hoover Report in midyear seems overshadowed by the deficit spending and the tight grip on one essential industry of its own dictator. Here again there are signs of revolt, but the fear of mass votes paralizes many.

It has been suggested that the wave of devaluation, a form of lèse majesté in England, and spreading over the world, may have shaken the faith of Europe in Santa Claus.

* * *

CLASSIFICATION—Classifiers are being used for desliming and dewatering 1200 tons per hour of ilmenite sands at the unique installation of Humphrey Corp. at Stark, Fla.—entirely water-borne on barges in a dredged pit, placer-fashion. The importance of high specification sand on Federal projects is reflected by the selection of our classifiers, hydroseparators and sizers for preparing concrete sand for the Detroit Dam in Central Oregon, the Hungry Horse Dam in Montana and the Buggs Island and Clark Hill Dams in the Carolinas.

PAN-AMERICAN JIG—The jigs of Pan-American Engineering Company, recently acquired and renamed the Dorrco Pan-American placer and pulsator jigs, are well established in placer mining where their operating characteristics indicate their use may be extended into several other fields, such as iron ore beneficiation and the concentration of other minerals.

CANE SUGAR—Our orders show that there is a notable and continuing appreciation of Dorr operation and service in the cane sugar world. Factory owners look upon the Dorr Multifeed Cane Juice Clarifier and the Oliver-Campbell Cane Mud Filter as necessary units to help to solve today's high-cost-of-sugar problems.

SANITATION—Our type M sewage digester demonstrated at Stamford, Conn. the advantages of rapid mixing of sludge during digestion, and many other cities are now installing units of this improved type. A compact unit for pre-aerating sewage, combining aeration and sedimentation, is still in the development stage but appears most promising.

FLUOSOLIDS—The roasting of areseno-pyrite gold ores has been demonstrated by the successful installations at Cochenour Willans and Campbell Red Lake, both in Ontario. Major advantages are easy operation, unusually close control of temperature and sulfur content of the calcine, plus self-roasting with an unusually small amount of sulfur in the feed.

ABROAD—In Europe our associated companies in England, The Netherlands, Belgium and France have had a fine year and progress continues in the rehabilitation of the companies in Germany and Italy. Consulting work abroad, done from this country, included a magnesia-from-sea-water project in Norway, copper leaching in the Near East, an aluminum sulfate program in India and continued work in chemical fertilizers. Our far-flung interests have carried members of our domestic staff to all the nations of Western Europe, Norway, Jugoslavia, Cyprus, India, Java, Australia, the Philippines and the Far East.

* * *

Our own year has been an exciting one in many respects. My election to Chairman of the Board with one of my oldest associates, Elmer R. Ramsey, becoming President has strengthened us, and the adoption of our "Tenure Stock" Plan in '48 has served to unite us still further.

A major undertaking has been the relocation of our General Offices in Stamford, Connecticut, with only an Executive suite with space for "Visiting Firemen", and Eastern Sales Headquarters being retained at 570 Lexington Avenue in New York, where we have been located since 1935. Looking back further, 1913 marks the date of my opening our first New York office with one Engineer.

The completion in November of our first Company film, "The Dorr Way," was a real milestone in our history. Since its mention here last year, final sequences were "shot" from California to New York, and the exacting work of editing 17,000 ft. of film accomplished. The finished film of 1200 ft. necessarily touches most lightly our work in a variety of fields. It is indeed a unique art that can happily compress many years work into 33 minutes, and still give a feeling of drama and continuity.

We have been writing again and have produced, with the greatly appreciated cooperation of many friends around the world, a revision of my book "Cyanidation and Concentration of Gold and Silver Ores," which was brought out by McGraw-Hill in 1936. This is now in the hands of the printer, and will carry the name of Frank L. Bosqui, our Chief Metallurigcal Engineer at Westport, as well as my own. When I started Cyaniding about 1900, his father's recently published book, "The Cyanide Process," was my bible.

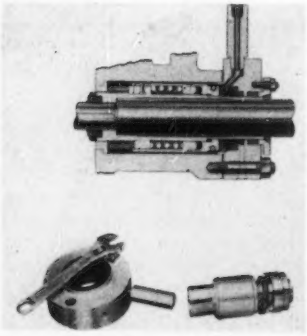
Another associate, George D. Van Arsdale, who was for many years with Phelps Dodge and largely responsible for the metallurgical process used at the leaching plant of the Inspiration Copper Company, is compiling and editing for us a book on Base Metal Hydro-Metallurgy. This should reach the printer early in the year.

To our friends and to Dorr staff and associates we send New Year's Greetings and with them an expression of our strong faith in the future.

John V. N. Dorr

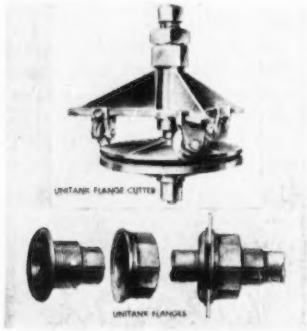
570 Lexington Ave., New York 22

DORRCO



14. MECHANICAL SEAL is available for centrifugal pumps in corrosive service at high temperatures and pressures. Replaces conventional packing. Byron Jackson Co., Los Angeles, Calif.

15. RUBBER PINCH VALVE is non-corrosive, non-clogging in handling corrosive liquids, semi-solids and dry granular material. Assures leakproof shut-offs. Wilcox Co., Philadelphia, Pa.



16. FLANGE CUTTER and Unitank flanges save time in making pipe-to-tank connections. Only one gasket is needed. Flange is threaded inside and out. American Pipe & Steel Corp., Calif.

For Your Files

This informative manufacturers' literature is free unless otherwise specified. To obtain bulletins circle their number on card (P. 102) and mail.

71. ANTI-CORROSION EQUIPMENT. A 36-page catalog of **Haveg Corp.'s** corrosion resistant equipment gives important data and dimensions on the company's products from absorbers to weather caps.

72. TOOL CONTROL. "How Tool Costs Were Cut 12 Ways in 20 Plants" is the title of **McCaskey Register Co.'s** new booklet on cutting costs by proper tool control. It is based on written reports, condensed for quick reading, and illustrated with amusing cartoons.

73. TEMPERATURE CONTROL. This is a complete guide for selection of H-B Double Diamond **(H-B Instrument Co.)** equipment used in signaling and controlling temperature in both laboratory and plant installations.

74. PUMPS. Catalog gives characteristic curves and specifications for **Nagle Pumps'** complete line of industrial pumps. Data on installation and design is included. Shown for the first time is type SW-OB vertical shaft pumps for handling mixtures containing quick settling solids.

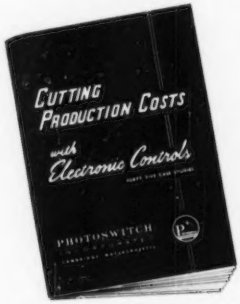
75. WIRE ROPE. Folder on **Macwhyte Co.'s** corrosion-resisting wire rope illustrates construction and contains tables showing breaking strength and weights for various sized rope of different designs.

76. STEEL. "For Longer Wear . . . Less Repair" is a 36-page illustrated story on how **Jones & Laughlin Steel Corp.'s** "Jalloy" is increasing equipment life at various mines. Included are 13 pages of technical data on the special alloy.

77. ELECTRICAL ACCESSORIES. Manual on electrical accessories, recently issued by **Ilsco Copper Tube & Products, Inc.,** contains technical data for use and installation and a thorough compilation of the countless dimensions, ratings, wire sizes, weights and descriptions.

78: SCREENS AND CRUSHERS. "Symons Cone Crusher and Symons Vibrating Screens in Portable and Semi-Portable Plants" holds valuable engineering information and many drawings suggesting equipment layout. **Nordberg Mfg. Co.** makes Symons Cone crushers.

79. MOBILE SHOP. Couse Manufacturing Co. describes its portable machine shop in this booklet. Shop provides for plumber, electrician, carpenter and blacksmith as well as for machinist, mechanic and welder. All equipment is transported on one truck.



88. ELECTRONIC CONTROLS involved in cost-saving production techniques are described in 45 case histories in this Photoswitch Inc. bulletin.

80. MATERIALS HANDLING ACCESSORIES. Attachments, tools and accessories for better material handling with **Hyster Co.** lift trucks, straddle trucks and mobile cranes are described in this catalog, with diagrams, photographs, specifications.

81. BLOWERS. Design and Construction features of single and multistage centrifugal blowers and exhausters are described in **Roots-Connersville Blower Corp.** Bulletin 120-B-14.

82. EXCAVATORS. This excellent bulletin, "Proper Sizing of Excavators," is third of a series put out by **Power Crane and Shovel Assn.** It deals with problems of correctly sizing the excavator and hauling equipment, and their proper synchronization to obtain maximum output, minimum delay. Working details, practical suggestions and performance tables are included.

Copies of this pamphlet cost 50c.

83. WEARING PARTS. Kensington Steel Co. has just issued Bulletin 1049 which pictures and describes wearing parts of Oro Alloyed manganese steels, for shovels and crushers. It points out which particular manganese steel renders best service for some particular application.

84. WELDING ELECTRODES. Directory gives list of electrodes available from **Eutectic Welding Alloys Corp.,** and appropriate services.

85. MOTOR-GENERATOR SETS. Folder gives a quick look at what **International Diesel Electric Co., Inc.** has to offer in the way of packaged engine generator sets.

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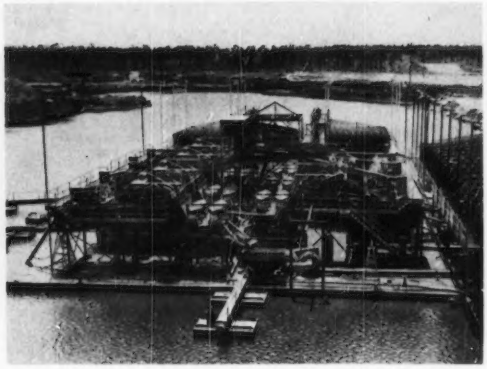
OPERATION ILMENITE, AT STARKE

SUCTION DREDGE on "traveling lake" mines ilmenite-bearing sands forward which it pipes to floating barges.



BARGE-MOUNTED scrubbers and spirals concentrate ilmenite, return sand to lake to restore land level.

Black Sand is Mined from Traveling Lake

PRODUCTION OF 100,000 TONS of ilmenite a year is the goal of operations at Starke, Florida.

A dredge on a "traveling lake" in north central Florida is mining the sands of north central Florida to get the black ore which is the raw material for titanium dioxide, the whitest white pigment ever made.

This development of the state's natural resources, which has created a new, permanent industry there, is being done by E. I. duPont de Nemours & Co., of Wilmington, Del., to get a continuous, American supply of the ore for its manufacturing requirements.

Located about six miles east of Starke, the site is a part of Camp Blanding on land leased by the duPont company from the State of Florida. The area being mined covers about 4,000 acres. This operation is the only venture of the company in the state at present. It has cost the company more than a million dollars up to now. Mining was started early this year and is being carried out by the Humphreys Gold Corp. of Denver, Colo., on behalf of the duPont company.

The "traveling lake," about half a mile long and 500 ft. wide, was dug out of the sandy soil. A dredge and separators floating on the lake, pick up the sand in front, take out the ore, and pour the sand back in again behind them. Thus the lake travels forward in the direction of the work—moving in where sand is removed and being pushed forward by the sand returned in back.

In this unusual mining operation, the sand is pulled up by a 20-in. suction dredge and piped directly to a floating conditioner (or "scrubber") barge. There the organic coating is removed and the heavy, black mineral is separated from the white sand by a system of spirals in a "wet mill." This system was devised by Humphreys as a better method of concentrating gold sands.

The "wet mill" pours the white sand back into the lake as back fill. The concentrate of ore is piped to a big "dry mill" which was erected on land. In this mill, the ilmenite is further concentrated by electro-magnetic and electrostatic separators. From there it is loaded into freight cars and shipped to duPont pigment plants at Baltimore, Md., and Edge Moor, Del., where it is manufactured into white pigment for paint, paper, rubber, and many other purposes.

The mine and plant perform in continuous operation and employ about 200 men, nearly all of whom are Floridians living in the general area. The same men who built the establishment were kept on to operate it.

At present the area is covered with second and third growth timber and is used for grazing under the control of the Florida State Armory Board.

Crews move ahead of the dredge, clearing the land of timber (principally for paper) and stumps (for turpentine). The area ahead continues to be used for grazing. Under the long-term lease with the State, the revenue from timber and stumps as well as income from grazing goes to the Florida State Armory Board. This is in addition to a royalty on the ore removed, which also goes to the Board.

As this development gets into full swing, the lake will be back-filled by the remaining sand and will be restored to approximately its present level and surface smoothness.

Recent discovery of an ancient buried forest in the area, as well as hard pan, caused the plant to be shut down temporarily during September so that more equipment could be installed to handle it. Now machinery has been devised which, it is believed, will cut through the hard pan and chew up the trees when installed. The company is aiming for an output of 100,000 tons of ilmenite a year when all obstacles have been overcome and the work is operating at full scale.

Concentrations of ilmenite in the sand there are so low that ten years ago there was no known method of extracting it on a commercial basis. Only the development of the spirals system by the Humphreys corporation made it possible. For every two tons of ilmenite recovered here, it is necessary to dig out 100 tons of sand, plus a lot of buried trees. This compares with other deposits being mined which run up to 75 tons of the ore in every 100 tons of material taken up.

IN MINING

IN THE UNITED STATES

- Bunker Hill Strike Settlement Omits Pensions—P. 110
- Potash Miners Go On Strike at Carlsbad—P. 116
- Optimism Spurs Uranium Development in Utah—P. 117

ALASKA

★Eight dredges of **Yukon Consolidated Gold Corp.** operated during the 1949 season with about 475 employed. Early in November, stripping was still continuing in all but one camp. A report from Fairbanks said the recovery of gold was fair.

James Richard Williams of **Montana Lead & Zinc Co.** said he would recommend to his company that development work be started as early as possible in 1950 at the Mahoney Creek mine, near Ketchikan. Mill, machinery, and water system would have to be improved, and 10 to 15 men would be needed for opening the work.

★**Harold Christensen**, manager for C. J. Berry Dredge on Mammoth Creek, reported in Fairbanks that the dredge had closed down in October, about 300 ft. below the main camp.

★**Livengood Placers** added equipment and personnel in November for opening the main tunnel in preparation for resumption of operations in 1950, according to Dan Byers, manager.

★According to a report from the U. S. Bureau of Mines, there is tin in Alaska. No lode tin had been located by the investigations, but enough placer tin to warrant a Government survey.

★**Pewabik Mining Syndicate, Ltd.**, recorded a deed in Fairbanks recently for 62 copper mining claims in the White River district. Mr. Wann and associates did exploratory work during the past season. Norman Stines is consulting engineer for the company.

ARIZONA

★Devaluation of the British pound has caused a shutdown at the **Shattuck-Denn Corp.** metal mill at Bisbee. Ability of foreign mines to ship metals into the United States cheaper than it can be mined in the area was responsible, officials said.

★After considerable controversy, the work week at **Miami Copper Co.** and **Castle Dome Copper Co.** in the Globe-Miami area has been restored to six days on and one off. Dissension was expressed at an earlier order calling for 12 days on and two off.

About 1,000 workers at Miami Copper and 500 at Castle Dome are affected. A company plan for a five-day week was discarded when union officials indicated they would seek the same pay for five days as had been received for six.

★**Eagle-Picher Mining and Smelting Co.** in Pima County has won a court fight seeking $24,822 it claimed had been paid the county in tax assessments. The court ruled that the assessment on plant and equipment was excessive.

CALIFORNIA

★The Plumbago gold mine near Alleghany, Sierra County, has been purchased by Dr. Vaughn Mitchell, of San Francisco. He has not yet announced plans for operation.

★Milling operations have been started at the Oriental gold mine near Alleghany, Sierra County. The available mill has a capacity of 75 tons of ore a day, and contains a 10x20-in. jaw crusher, 5x5-ft. ball mill, classifier, with jig between it and ball mill, six flotation cells, and a pan batch-type filter. Mine development consists of the main Oriental adit nearly 5,000 ft. long and drifts driven east and west on the Oriental vein.

★V. B. Bennett, of Sacramento, is moving dragline dredge equipment to placer holdings at Red Flat five miles above Junction City, Trinity County, following completion of a road to the dredge site.

★At the end of its first month since reorganization of operating procedures, **Central Eureka Mining Co.** reported a net profit for October of $18,244. This contrasted with an average loss of $29,500 for the first four months and $8,250 for the second four months of this year. A single-compartment winze at the mine is considered a bottleneck. Mining authorities have suggested that the problem be worked out by sinking the old Eureka shaft an additional 1,100 ft. to the 43rd level and running drifts to orebodies on the 37th, 38th and 39th levels, provided enough ore is developed on those levels to justify the investment.

★**Fairview Placer Co.** is operating a gold dredge on Stuarts Fork of the Trinity River near Minersville in Trinity County. Purchased from the **Junction City Mining Co.**, the dredge has been rebuilt with the addition of six pontoons, the lengthening of the digging ladder by 8 ft. and the installation of eight Yuba placer mining jigs. Harry B. Murphy is general manager of Fairview Placer and Harold C. Young superintendent of operations. The dredge is operated three shifts per day, employing 23 men.

★The Don claim of the Hi-Grade gold mine in Mint Canyon in Los Angeles County is deepening an old shaft. A drift will be driven southward on the vein at 65 ft. So far, exposures of the gold-bearing vein in the shaft range in width from 12 to 22 in.

★**Copper Hill** copper-zinc mine with properties in northwestern Amador County and El Dorado County is being unwatered for exploration.

★A selective flotation plant of 50-ton daily capacity is in operation at the **Penn mine** near Camp Seco in Calaveras County. Ore is being taken from the 500-ft. level after unwatering of the No. 3 shaft to the 700-ft. level. A bulk concentrate is planned for the future instead of the separate copper and zinc concentrates that have been shipped. An attempt is being made to avoid high smelter and freight rates by treating concentrates on the mine property. A pilot plant has been erected.

★**Sisko Mining Corp.** is prospecting a gossan outcrop in the Dillion Creek area of Siskiyou County near Happy Camp. Gold and copper minerals occur in a quartz gangue together with iron pyrite in shear zones. The deposit is being prospected by trenching and by diamond drilling.

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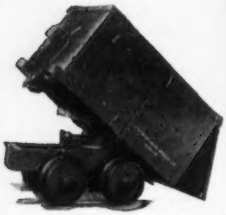

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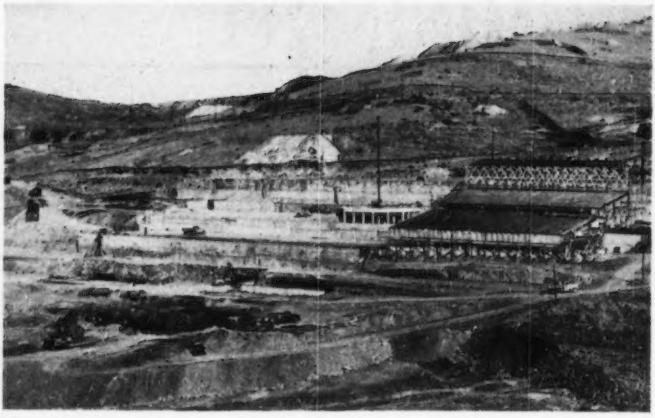


CONSTRUCTION OF NEW MILL keeps 100 workers busy at Cripple Creek, Colo., where Golden Cycle Corp. is putting up this 1,000-ton daily capacity plant. Made of steel and concrete, the mill is being built on five concrete terraces. Construction should be completed next year and full operation started by 1951. The plant will cost a million dollars and require 50 men to operate.

California *(Continued)*

★**Yuba Consolidated Gold Fields** has six giant dredges in the Hammonton area near Marysville, each equipped with 18-cu. ft. buckets. The dredges dig 124 ft. deep and handle about 450,000 cu. yd. per month. The company is preparing to redredge 5,000 acres in the field.

Reconditioning of the company's Sunny View dredge has been almost completed and work at the Sunny View property south of Chico will be resumed soon. Operations there were suspended in 1942.

Yuba is working at the highest level since 1941 and is reportedly recovering about 100,000 fine oz. of gold a year.

★**Snelling Gold Dredging Co.'s** shop in Snelling was destroyed in mid-November by a fire causing damage estimated at $100,000. The shop contained machinery, fittings and other dredging equipment.

★California gold producers have interpreted a recent Treasury Department ruling that amalgam may be acquired and held as raw gold as permitting unlimited sale of the "gold sponge" at the best price obtainable.

Important California lode gold producers are reported to be selling raw gold above $40 an oz., and are expected to be able to increase their sales at the premium price under the relaxed ruling.

★Discovery of rare-earth minerals has been made in an unusual geological formation near Mountain Pass Service Station on Route 91 in San Bernardino County. U.S.G.S. states that within an area of about 600 by 1,500 ft. underlain by Archean rocks, there are at least five veins, three of which contain considerable bastnasite, a fluocarbonate of cerium and lanthanum, with thorium and uranium. Uranium and thorium content is too small to make the deposit a commercial source for those elements.

★Permission to prospect for ilmenite from the dredgings of Mission Bay, $16-million acquatic recreational area and flood control project under construction at San Diego, Calif., has been denied Stuart H. Ingram, Pasadena, Calif., mining engineer.

COLORADO

★The Leadville drainage tunnel is in unexpectedly good condition after four years of abandonment, according to an inspection party of the U. S. Bureau of Mines. This unfinished project to drain base-metal mines in the Fryer Hill basin can be extended with virtually no major repairs on the 6,600-ft. portion already driven. The U. S. Bureau of Mines hopes that the new $500,000 appropriation will make it possible to extend the tunnel and lateral about 2,900 ft. Actual work will not begin for another two or three months.

In a recent conference between property owners in the area and the Bureau, it was suggested that the size of the tunnel be decreased to permit extension of the tunnel as far as possible with available funds. Bureau officials are now preparing bid specifications so that contract negotiations can be completed and actual work started in February.

★A group of Colorado Springs business men have taken a lease and option to purchase the Alma Placers in Park County, and have organized

Platte River Placers, Inc. Phillip G. Cole is president. The ground is now being tested by churn drilling. Albert S. Konselman, mining engineer of Colorado Springs, is in charge of the work, and is acting as manager and consulting engineer for the new company.

★The Clear Creek Metal Mining Association was opposed to changing Public Land Laws at a recent meeting with members of the Bureau of Land Management held in Idaho Springs. It was contended that holders of mining claims would suffer hardship if claim laws were changed at this time. Senator J. Price Briscoe outlined the miners' opposition.

★Five concrete terraces and steel framework for **Golden Cycle Corporation's** new 1,000-ton mill are now being completed at Cripple Creek. The new mill will spare custom shippers the 45-mile haul to Colorado Springs. The new mill will require only 50 men to operate it as against 200 men for the old mill.

★**Chain O'Mines Co.** is placing new transformers at Black Hawk to power the company mill. It is reported that large power shovels will be used to mine ore exposed on the surface near the glory hole on the property.

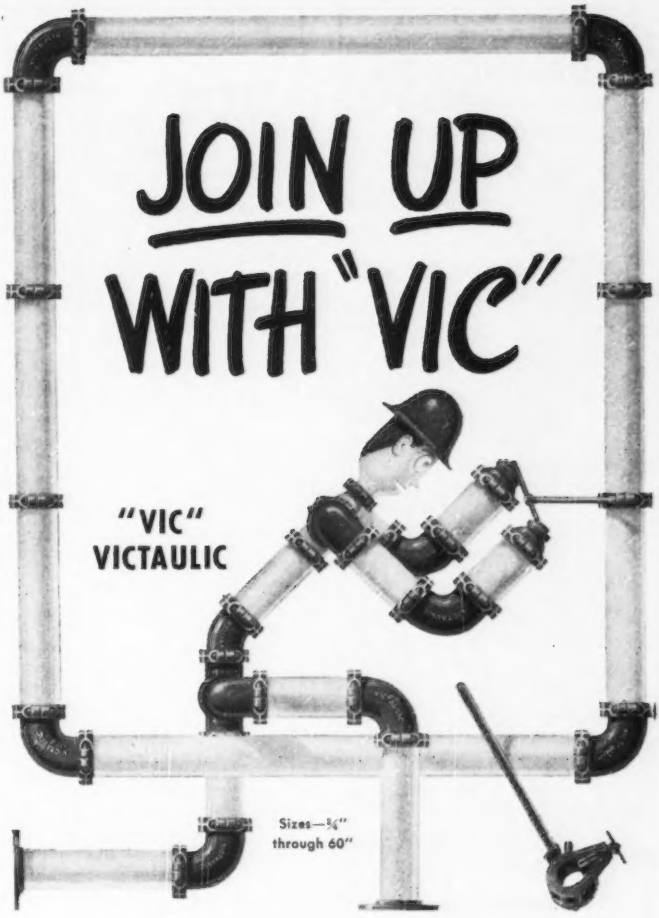
★**U. S. Vanadium Co.** is operating its Rifle plant at full capacity. The remodeled Uravan uranium-vanadium concentration plant will start operations soon. The company is also completing a crushing and sampling plant at Thompson, Utah.

★The Mollie Kathleen gold mine at Cripple Creek has resumed operations, according to Lee Brown, mine superintendent. Lessees have started work on four blocks of ground in the property. The company is owned and operated by **Markley Mining and Exploration Co.** P. W. Markley, of Philadelphia, is president.

★**Silver Shield Mining and Milling Co.** is completing installation of a 200-ton mill transferred from Hawthorne, Nev., to Ouray, Colo. The mill will process gold, lead, silver and other ores discarded in previous years because they were too lean to work, according to L. E. Stein, vice president of the company.

★**Callahan Zinc-Lead Co.** is installing a new tailings disposal plant at its Whitepine property. The unit will filter, dry and dispose of tailings without polluting nearby streams. Water extracted from the tailings is purified and piped back to the 100-ton mill on the property. The new addition to the plant cost about $15,000.

★**Dr. Adam Michalo, Jr.,** of Gunnison, Colo., has begun research to determine the effect of radioactive ores on miners at Nucla, Colo. Dr. Michalo will study the effects on miners in the Uravan, Naturita, Norwood and Redvale areas.



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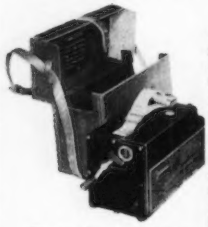

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Applicable to any size belt conveyor, horizontal or inclined. An accurate and dependable means of keeping constant check on production.

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Kellogg Strike Settlement Terms

Agreement for settlement of strike. Summary of terms. The old contract to be adopted, subject to the following terms:

PREAMBLE

Agreement is made by and between Miners Local (No. 18 or 14) of the International Union of Mine, Mill & Smelter Workers, and the company.

EXPIRATION DATE

Contract will expire June 30, 1952. It can be opened in June, 1951, on wages, holidays, vacations and social benefits.

SIX-DAY WEEK

Operations will be resumed on the basis of a six-day week, but always subject to wage negotiations if the work week is reduced.

VACATIONS

No worker will lose vacation pay as a result of the strike or shutdowns. The qualifying period for vacations will be extended for the period during which an employee has been out of work.

NON-DISCRIMINATION

There will be no discrimination in respect to re-employment when work is resumed.

HEALTH AND WELFARE

Present employee 24-hour hospital contract coverage to continue.

For the wives and children the operators and employees will participate in a new plan for hospitalization, surgery, and medical benefits. A joint Union-Management-Doctor-Hospital committee will be established to study various plans and decide what plan will be undertaken. Until such a plan is decided upon the present Blue Cross hospitalization and present payments will continue. This plan will be voluntary and it will be up to the employee if he wants to voluntarily participate.

SENIORITY

Smelter and Zinc Plant agree to continue present practice with respect to departmental and plant layoffs and rehiring.

SICK BENEFIT PLAN FOR EMPLOYEES

A plan for "off-the-job" sickness and "off-the-job" accident is to be provided for every employee, single or married. The employee will participate in this plan voluntarily. The operators agree to pay 50% of this plan. A Union-Management committee will be established to study various ways that this employee benefit can be purchased.

Colorado *(Continued)*

★Colorado Mining Association, in cooperation with other mining groups announced a general mining meeting to be held in Denver on February 2, 3 and 4.

★Arthur Bunker, new president of **Climax Molybdenum Co.**, and Weston Thomas, company treasurer recently visited operations at Climax. The Storke level tunnel which has been driven by the Grafe-Callahan Construction Co. has been completed.

★J. W. Reinenrath, county treasurer at Cripple Creek, reports that interest in gold mining properties is greater than it has been in the past 20 years. Renewed interest is reflected in increased tax collections. Tax receipts for 1949 exceeded those for 1948 by 250, he said.

IDAHO

★The strike in the Coeur d'Alene district involving about 2,800 workers which started with a walkout at the **Bunker Hill** smelter on Aug. 20 ended on Nov. 20 when the Wallace local of IUMM&SW (CIO) voted to return to work. It is estimated that the strike cost the miners about $1,747,500 in lost wages, and the district lost about 71% of its silver production as a result of the work stoppage.

The strike was first broken when the Kellogg union voted to return to work on Nov. 12. The Kellogg area involves the Pine Creek district where several small lead-zinc producers were forced to close by the strike.

The Kellogg break followed an agreement between the Kellogg local union negotiating committee and the Kellogg area operators at a meeting with the joint district negotiating committee. Terms are shown above. No further pension clauses were included.

★The Wallace local union's decision to return to work followed an offer by the **Day Mines, Inc.**, to include a new life insurance program in line with other large operators in the Wallace area *in addition* to agreement with the Kellogg settlement terms. The plan follows:

"All Day Mines, Inc., employees after three (3) months service will automatically be covered by $500 life insurance at the expense of the company. In addition, each eligible employee, at his expense, will have the privilege of taking out an additional $500 insurance at the group premium rate."

Under the terms of the above

agreements all of the silver-copper, silver-lead and zinc-lead mines of the district that were affected by the strike, and the Bunker Hill smelter and Sullivan zinc plant have resumed normal operations.

★**Hecla Mining Co.** established the fastest tunnel driving record in the Coeur d'Alene district by driving the Rock Creek tunnel, midway between Wallace and Mullen, 4,483 ft. in 213 days, or appoximately 21 ft. per day. The tunnel has been driven to prospect a large mineral area at depth. Work on the tunnel has been stopped temporarily. Major objective of the tunnel is a wide shear zone containing galena mineralization.

★The U. S. Bureau of Mines estimates that commercial phosphate rock reserves in Bear Lake and Caribou Counties total about 230,000,000 tons. Production during 1947 totaled about 905,000 tons from this area. Western fertilizer plants used about 23% of the output. The balance was exported.

★Bunker Hill smelter will build a new stack at a cost of about $100,000 to replace the original one which has been in use for 30 years, according to J. B. Haffner, resident manager.

★**Sunset Minerals**, operating the old Liberal King property on Pine Creek has opened an orebody between the 1,000 and 800-ft. levels that averages about 10 ft. wide and assays 12% lead, and 18% zinc and 4 oz. silver per ton according to Bliss Moore, engineer in charge.

★**Highland Surprise Mining Co.** in the Pine Creek area, has developed its main orebody on the 1,300-ft. level according to Frank J. Luedke, president who reports the ore to be 10 ft. wide with 3 ft. of high-grade lead-zinc ore.

★**East Lemhi Mining Co.**, operating in Lemhi County, has reopened the Leadville mine at Leadore, Idaho, and has discovered a galena vein 9 ft. wide in the upper workings, according to J. F. Arnold, of Spokane, secretary-treasurer of the company. The company plans a 100-ton milling plant.

IRON COUNTRY

★Iron ore miners of the Lake Superior region returned to work Nov. 14, after settlement of the strike which started Oct. 1. Gains for the men are represented by a pension system providing $100 per month at the age of 65 for those who have worked for 25 years. Individual contracts vary in details but the over-all pattern is approximately the same. Employees of **Inland Steel Co.** are offered two pension plans, one supplementing the other. The first provides $100 per month after 25 years of service. Under the second plan, a voluntary contributory plan, the em-

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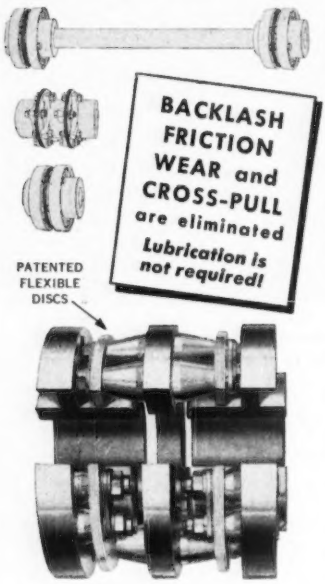

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Iron Country *(Continued)*

ployee can acquire pension credits which are good even if he leaves the company. The resulting increased contributions will bring the pension to a maximum of $337.50 per month, not including social security.

★As most of the men at the Champion iron mine wanted to get off during the first week of the deer season the mine was closed for that period. While the men were gone a crusher was installed. This mine has shipped during the past season over 70,000 tons. Production stated around Apr. 1. For the future it is planned to mine on one shift per day and hoist on two shifts. This will allow an annual production of 140,000 tons per year. The ore is a high-grade hard hematite and is sold to the U. S. Steel Corp.

★**Cleveland-Cliffs Iron Co.** recently started a new mine at the east end of Lake Angeline within the city limits of Ishpeming. The deposit contains approximately 80,000 tons of soft hematite. Overburden approximates 40 ft. in depth. The water level of the lake is rising at such a rate that the ore must be removed this fall. A. Lindberg & Sons received the contract to strip and transfer the ore to the old Lake shaft stockpile ground which will be free of water until shipping season opens next spring. A 1,500-gpm pump is being installed.

★A fire broke out in **Republic Steel Corp.'s** Penokee mine at Ironwood, Mich., on Nov. 26 and the blaze was brought under control without loss of life by the following Monday. Mine officials believe it was started by a hot bolt dropped by a repair crew in the shaft near the 870-ft. level. The shaft was only used to transport supplies and personnel. The 400 men employed have returned to work.

★Shipments of Lake Superior iron ore for the entire season amounted to 69,556,269 tons as compared to 82,937,192 tons for the year in 1948. Most of the 13,380,923 ton decrease was due to the strike of Lake Superior miners during October.

★Shipments of Lake Superior ore vessels during October totaled 1,574,813 tons as compared to 10,028,578 tons during October, 1948. This large decrease was due directly to the strike.

★Two mines of the **Oliver Iron Mining Co.** on the Mesabi range were awarded the "Sentinels of Safety" trophies for 1948 for having had the best safety records in their divisions. They were: the Spruce mine at Eveleth, which worked 588,221 man-hours with no lost-time injury during the year; and the Fraser underground mine, at Fraser, which worked 109,412 accident-free man hours and won top honors in its classification.

Other mines of the company on the Range that were honored for operating a full year without a disabling injury were the Monroe, Pillsbury and Hartley, all at Chisholm, the Fraser and the Canton mine, at Biwabik.

★R. T. Elstad, president of **Oliver Iron Mining Co.**, Duluth, stated that the company's winter program would include the moving of 7½ million cu. yd. of stripping, the construction of a new conveyor belt and beneficiation plant in the Canisteo district and a crushing and screening plant in the Hibbing-Chisholm district.

★The **M. A. Hanna Co.**, Hibbing, Minn., is drilling test holes "on a strictly speculative basis," on a number of farms near Wilson, Wis. Iron was mined in this territory about 50 years ago. Wilson is about 45 miles east of St. Paul.

★**Republic Steel Co.** has notified the Village of Hibbing that the Susquehanna mine stripping dump will cover a portion of the present sewer line from Kitzville. The company will cover the line with a concrete slab to protect it. The council will hold the mining company responsible for any damage to the line.

★With the signing of labor contracts by **Charleson Mining Co.** and **Snyder Mining Co.**, all operators have settled with the union. Some of the smaller companies, like the Stanley Mining Co., which operates the Mary Ellen mine at Biwabik, worked through the strike by virtue of an agreement with the union to adopt such pension plan as was ultimately accepted by the larger companies.

★November 16 marked the 60th anniversary of the discovery of iron ore on the Mesabi. The date passed practically unnoticed by operators.

★The **W. S. Moore Co.** of Duluth, of which Hiram Reese is general manager, shipped 607,957 tons of ore in 1949 from six properties located at Eveleth, Virginia, Mountain Iron, Buhl and Keewatin. The largest contributor was the Prindle mine at Virginia, which furnished 313,407 tons from mine and stockpile. It is planned to move about 300,000 cu. yd. of stripping at the property this winter. The Prindle was formerly operated by Oliver. The W. S. Moore Co. expects to ship almost as much ore in 1950 as it did in 1949.

★The Industrial Bureau of the Duluth Chamber of Commerce has recommended a resurvey of the iron powder plant at Aurora by independent engineers and metallurgists. The Iron Range Resources & Rehabilitation Committee was informed that this action was taken because "production problems are being encountered and more money is requested for the plant." About $1 million has been invested in it, three-quarters of which is State money.

★Employees of **Inland Steel Co.** have been informed that, while the new agreement with the CIO union pro-

vides for pensions for all employees according to the Bethlehem pattern, those now covered by Inland's contributory plan may continue under this if they so elect. It is not clear whether there will be any advantage in doing this.

★The Montreal mine at Montreal, Wis., is deepening its No. 6 inclined shaft from the 39th to the 40th level. This will make it 2,200 ft. below sea level. The shaft handles supplies. No. 5 vertical shaft is the main ore-hoisting outlet.

★The first mine to resume work on the Menominee range was **Republic Steel Co.'s** Tobin property. Development work, preliminary to resumption of production, was not interrupted at the **North Range Mining Co.'s** Warner mine near Amasa and **Inland Steel's** Bristol mine at Crystal Falls.

★The Champion mine of the **North Range Mining Co.** was idle for a few days while a new crusher was being installed. It was not affected by the strike as the employees there have no union. Operations at the mine did not get under way until April and about 70,000 tons will be shipped for the season. Future plans call for shipping about 140,000 tons per year, with mining on one shift and hoisting on two. The ore goes to U. S. Steel which owns the fee.

★The week ended Dec. 3 found most mines in the Iron River area through shipping for this season. As of Nov. 28, the Buck, James and Davidson of **Pickands, Mather & Co.** had finished and the **Inland Steel's** Sherwood had made their last shipment. The Spies mine of **Cleveland-Cliffs** had 55 cars to load for its last boat. The Wauseca, Homer, Hiawatha No. 1 and No. 2, and the Bengal, all of the **Hanna companies** were shipping but were nearing the finish. Most of the mines have resumed winter stockpiling.

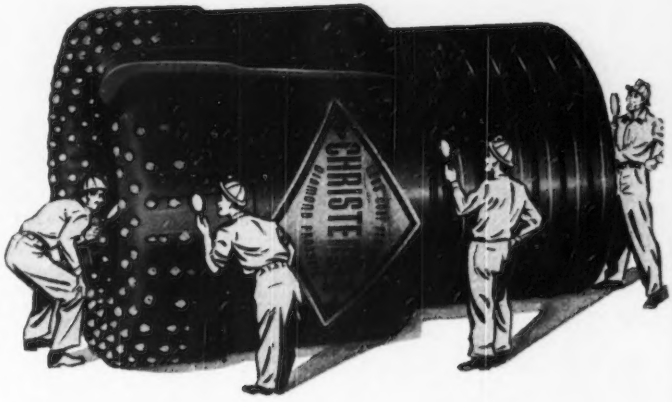
★The new addition to the Michigamme reservoir dam of the Wisconsin-Michigan Power Co.'s hydroelectric plant near Crystal Falls, Mich., on the Menominee range was scheduled to be in operation in December. Construction was started in July, 1948. The new plant will now have a capacity of more than 10 million kilowatt-hours annually. Power will be made at 4,160 v. and raised to 69,000 v. by transformers for transmission over the lines of the system. Operation will be semi-automatic.

★Lake Superior iron ore shipments from Upper Lake ports up to Nov. 1 totaled 68,282,382 long tons, compared with 75,197,022 long tons on the same date last year. Of this total, 1,549,681 long tons was shipped from ports in Canada.

★It is reported that Steep Rock Mines are negotiating for the purchase of a 34-in. hydraulic dredge for stripping 50,000,000 cu. yd. of overburden at the Steep Rock Mine.

PROVED

PERFORMANCE



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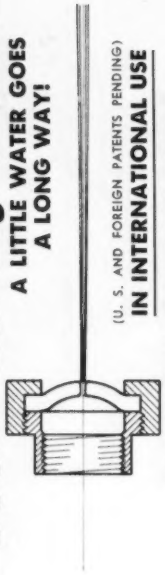
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KENTUCKY-ILLINOIS

★Temporary shutdowns were ordered by three major producers in the Kentucky-Illinois fluorspar district within recent weeks. Since then two of the plants have reopened. **Rosiclare Lead and Fluorspar Mining Co.**, at Rosiclare, Ill., was down, pending experimental pressure grouting in an effort to shut off a flow of underground water into the mine at the rate of 7,000 gpm. The mine has been allowed to fill up, and results of the experiment probably will not be known until de-watering is completed. Increasing stock of finished concentrates on hand and declining orders for shipments were the direct cause of the temporary shutdown.

★**Alcoa Mining Co.**, fluorspar division, subsidiary of the Aluminum Company of America, shut down its Rosiclare plant because of Aluminum Company strikes at its various units in the East and South. The strike has been settled and the mill will operate on a four-day-week.

Closing down of **Inland Steel's** plant at the Keystone fluorspar mine in the Kentucky district was ordered because of an adequate supply of finished ore on hand at present.

Several hundred employees in mining and milling operation at the three plants are affected by the shutdown.

MICHIGAN

★After passing through an extremely trying period from the operating viewpoint, **Calumet & Hecla Consolidated Copper Co.** expects to show a definite improvement in results for the last quarter of 1949. All three of the company's principal projects of the last few years are practically completed and paid for. The new tube mill at Decatur, Ala., is running at a profit. The company's new zinc-lead mine in Wisconsin is producing and, even at present low prices for concentrates, is expected to be working profitably early in 1950. The new power plant at Calumet is in use and should effect economies in operating costs of the Calumet division.

The company's tube business is improving, and there is a ready sale for all the copper the mines and smelter can produce.

Although the mines are being worked with the most rigid economies, it is realized by the management that the low-grade ores in the Calumet area cannot be worked indefinitely at present copper prices. The company is still hoping for some sort of subsidy legislation when Congress reconvenes. This would enable it to continue the development of the low-grade ore and make long-range plans, thus insuring the stability of the industry in the Michigan district.

Refinancing of Calumet & Hecla's term loans which had heavy maturities coming in the next few years, has put the company in a good financial condition. A combination bank and insurance company loan running for 15 years has not only paid off the old term loans and current bank loans, but also provided $1,750,000 of additional working capital. These loans can be paid off, at the company's option, in about half the period stated, without penalty.

MONTANA

★The late James R. Hobbins, president of the **Anaconda Copper Mining Co.**, one hour pervious to his sudden passing on Nov. 14, 1949, authorized the full scale resumption of the fire-filling and other work on the Greater Butte Project, part of which was suspended June 6, 1949. This is the project that started in the latter part of 1947 and the early part of 1948 to mine and mill approximately 130,000,000 tons of low-grade ore at Butte, from which it is expected there will ultimately be recovered 2,600,000,000 pounds of copper, plus substantial amounts of gold and silver. Main entry to the project will be through the Kelley Shaft, a few blocks north of the business district in Butte. It is now about 600 ft. deep. Mr. Hobbins also authorized the reopening of the Belmont copper mine in Butte, at which work was suspended on June 6. Shipments of ore from the zinc dumps in Butte are again going forward to the smelters.

★**Ambassador Mines Corp.**, which owns 21 claims 15 miles southwest of Trout Creek, Sanders County, Montana, has driven its main crosscut tunnel over 1,500 ft. and expects to tap its Wanda vein at a point 1,800 ft. from the portal. The Wanda vein assays high in silver and gold on the upper levels. At the annual meeting of the company, M. J. Unger was elected president; John R. Cross, vice president, and E. I. Fisher, secretary-treasurer.

★Arthur Loiselle, Basin, Mont., and Joseph Farrow, Butte, have taken over and are operating the Buckeye and Boston group of mining claims in the Big Limber mining district, near Basin, Jefferson County, Mont.

★William Morrow of Basin is doing preliminary work preparatory to taking lead and silver ore from the Bluebird claim in Galena Gulch, near Basin, Jefferson County, Mont.

★**Montana Power Co.**, next spring, will start work on an 83-mile natural gas pipeline connecting Bozeman and Butte and which will also connect the two main Montana sources of the company's natural gas supply, Cut Bank, Glacier County, and Dry Creek, Carbon County. It is possible that this new line may supply fuel for mining districts adjacent to the new pipeline.

★**Girds Creek Vermiculite Products Co.,** recently incorporated, is developing an extensive vermiculite ore deposit on the north fork of Girds Creek, near Stevensville. Work is being supervised by Bob Chamberlin and Cliff Jacobson, who are the largest stockholders in the company. Plans call for mining and processing the vermiculite ore, the processing plant to be located near Hamilton.

★At the annual meeting of the Madison County Mining Association, Claude Dale, Jr., Twin Bridges, was elected president for the ensuing year, succeeding R. R. Matthew, of Virginia City. Gordon McLeod, Norris, was elected vice president; Fred W. Bleck and R. B. Vickers, both of Virginia City, were respectively re-elected secretary and treasurer.

★Nancy Lee Mines, Inc., near Superior, Mineral County, is getting ready to extend an old tunnel to tap a silver-lead orebody recently encountered in the upper workings. The lower tunnel will have to be driven about 300 ft.

NEVADA

★**El Dorado Gold Mines** reports a gold ore assaying $60 to $70 a ton has been discovered in the Alabama mine in the Awakening district 50 miles northwest of Winnemucca. The company recently completed a stamp mill to handle 50 tons of ore daily.

★Discovery of rich lead ore in Queen Canyon, south of Montgomery, has caused a moderate rush into the area. Many claims have been staked near the old Queen mine. Ed Vogel, Mina mining man, is extracting high-grade ore along a slip fault he found near the Queen mine, and preparing to truck it to a Utah smelter.

★Installation of a 2,500-yd. capacity dragline dredge for working the gravels of Placeritor was decided on at the recent meeting of the directors of **Gold Ophir Placers, Inc.**

★If an ample water supply can be developed, large-scale operations are planned next summer at the **Gold Queen** group of 14 placer claims in the Sylvania district. Installation of the equipment will start soon.

★Although several of Nevada's largest producers have curtailed production, 3,289 persons were employed in mining in the state as of Nov. 1.

NEW MEXICO

★Johnny Jones, Las Vegas, is planning to develop a mine north of Florieta, in which he is apparently working on a continuation of a rich vein of complex copper and silver ore that was worked for a number of years at Terrero, in Pecos Canyon.

★Some mica is being shipped from

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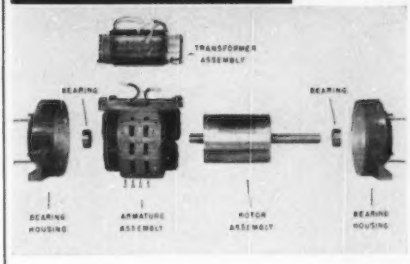

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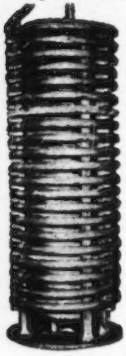

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New Mexico (*Continued*)

the Elk Mountain district, San Miguel County.

★**Great Lakes Carbon Co.** is shipping about nine cars of crushed perlite rock per week from its deposits west of Socorro. Crushing facilities are being expanded with a view to ship only sized materials. The company also owns a deposit in the northern part of New Mexico, in Rio Arriba County.

★Plans are being made to set up custom perlite exfoliating facilities at Albuquerque. **Perlite Development Co.** expects to be in the business before the end of 1949, with a small furnace. Another company is being formed.

★With zinc-lead-copper activities down, some increased interest is being shown in gold mining in New Mexico. Fred Shafer, of Silver City, is prospecting for gold and silver in the White Signal district, Grant County, and doing some development work.

★H. Meerschudt and W. S. Beal, of Las Cruces, have leased four claims west of Las Vegas for the mining of asbestos. B. F. Marctoat, president and general manager of the **Empire Mining & Milling Co.**, Las Cruces, has announced plans to ship mining machinery to the location.

★Mining activity at Organ, east of Las Cruces, has been increased. W. A. Haeberle has been doing development work on the Memphis King, and recently ran into considerable radioactive ore containing a secondary uranium material. The U. S. Bureau of Mines is reported ready to diamond drill on the Torpedo mine belonging to L. B. Bentley.

★V. F. Foy is preparing to ship several cars of copper-gold ore from the Buckeye mine in Water Canyon in the Magdalena Mountains.

★H. E. McCray is continuing his development program at several fluorspar properties in the Fluorspar Ridge section near Deming.

★**The International Union of Mine, Mill and Smelter Workers (CIO) called a strike Nov. 19 at mines and plants of the three potash producers operating in the Carlsbad, New Mexico, area. The three companies operating in the district are the United States Potash Co., International Minerals & Chemical Corp.**, and the **Potash Company of America.** The work stoppage grew out of wage dispute.

★New Mexico's collections of severance taxes dropped $7,753 in October under the same month a year ago. The state's new severance tax law passed at the 1949 session of the legislature is blamed. This law set up a $200,000 exemption on mineral production, intending to protect small operators, but wording of the law allows individual operators supplying major companies to avoid the tax. The problem has been placed before the state supreme court for disentanglement.

★Representatives of closed copper and zinc mines in southwestern New Mexico are reported to have told state officials that they would re-open if the union (Local 890, International Union of Mine, Mill and Smelter Workers) would accept a sliding scale of wages geared to the fluctuation of prices. The union is demanding higher wages.

Minimum activity at Chino and other copper and zinc mines in the Grant County district has idled several thousand miners.

NORTH CAROLINA

★American Vermiculite Co. has opened a processing plant at Spruce Pine, N. C., with C. D. Taylor in charge of the mining and Harold Dellinger managing the plant. Extensive deposits of vermiculite exist in several areas of the Spruce Pine district and plans for developing them have been made at intervals during the past 20 years.

OREGON

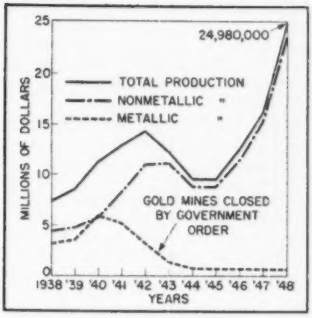
★Directors of the **Western Fertilizer Association** are considering the construction of a large phosphate fertilizer processing plant of about 100,000 tons annual capacity. The association recently obtained a perpetual Government lease granting mineral rights on 1,500 acres of the Dry Ridge phosphate deposit near Soda Springs, Ida.

Reporting to the annual convention at Portland of the Pacific Supply Cooperative, major stockholder among eight Northwest co-operatives forming Western Fertilizer, General Manager Charles Baker said that availability of low cost electric power will be a determining factor in deciding on a location for the proposed plant. The Bonneville Power Administration has been asked to extend transmission to the southern Idaho area. Baker reported that the difference between cost of processing under existing Idaho rates and those charged by Bonneville would amount to $8 a ton, "enough to eliminate the co-ops from a competitive position."

Possibility of locating the plant in the Columbia River area to get advantage of Bonneville rates was forecast in event extension of Bonneville lines is not provided.

★**Waite Minerals, Inc.**, owner of the Queen of Bronze and Cowboy mines in Josephine County, has purchased a Mace smelter for operation as a customs smelter in addition to treatment of production from its own properties.

★**Pacific Carbide and Alloys Co.** has received at its Portland plant a five-car shipment of limestone from the



OREGON'S MINERAL OUTPUT

marble quarry near Enterprise, Ore., which it recently acquired from the Reconstruction Finance Corp. Regular shipments will follow for burning in the kilns at the Portland plant.

UTAH

★Interest in Utah uranium production continues high, centered chiefly in the new **Vanadium Corporation of America** operations at Marysvale, where Bullion-Monarch is already in the field.

Discussing the Marysvale situation as seen by VCA, D. W. Viles, general manager of Vanadium, stated the present orebody seems of sufficient quantity to justify building a processing plant at or near the diggings 6 mi. northeast of town. "Very satisfactory" tests from the ore are reported from the Vanadium Corp.'s uranium plant at Naturita, Colo. However, the Naturita plant, some 300 mi. distant from the new mine, is not situated geographically to handle Marysvale ores economically. Marysvale, on a branch line of the D&RGW 210 mi. south of Salt Lake City, is well located to handle processing operations.

Claims leased by VCA total about 200 acres, with the uranium found in autonite lying in decomposed granite. The deposit, found by Pratt Seegmiller, a Marysvale miner, lies across a hill from the Bullion Monarch properties. Seegmiller stated diamond drill tests indicate the orebody runs in an 800-ft. length down to a known depth of 35 ft., with width as yet undetermined.

Present VCA operations include the sinking of a 30-deg. incline along what appears to be an enriched zone some 6 ft. high standing more or less vertically. VCA operations under Rex Smith, engineering superintendent, call for sinking to a depth of 60 ft., followed by north-south drifting to prove out the orebody. Reports are that the entire zone carries about .25% uranium, with some chimneys running as high as 1.5%. Other reports say the orebody will return .36

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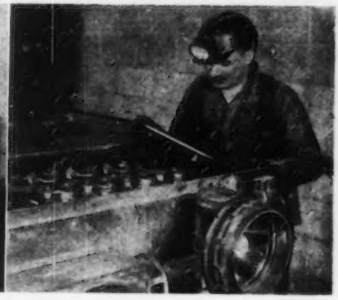

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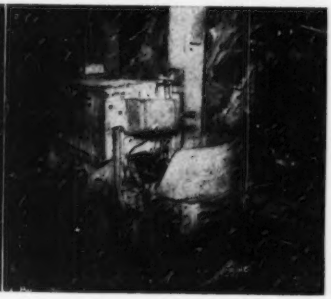

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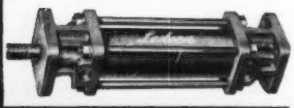

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Utah *(Continued)*

to .76% uranium, as compared to the .1 to .2% uranium content in carnotite. The autonite seems to occur in lodes, making the processing somewhat easier than in the case of carnotite.

★**J. R. Simplot Co.** has purchased or leased 160 claims in Bull Canyon, just over the Colorado line between La-Salle, Utah, and Naturita, Colo. The Simplot operation consists of cleaning up old workings and shipping out whatever uranium is found. A diamond drilling program has been reported with Simplot plans calling for erection of a mill if ore found stands up to expectations.

★Production of five major non-ferrous metals in Utah for October, 1949, was from 15 to 23% below production of similar metals in 1948. Declining metal prices and labor stoppages are principal factors.

★Importance of mining operations to Utah communities was pointed up publicly this month with the payment of a $4,480,000 Salt Lake County tax check by the Kennecott Copper Corp. The check represented taxes assessed against the Bingham open-pit mine and refineries in nearby Garfield, located in Salt Lake County. The single payment for 1949 represented 25.6% of the entire Salt Lake County tax bill.

★With citizens' groups in Magna claiming perilous smog conditions exist in the community due to American Smelting & Refining Co. installations, conferences involving smelter officials, Utah's state health commissioner and citizens' representatives are being arranged to study the matter.

AS&R hopes to have enlarged its plant for the recovery of sulphur dioxide from smoke stack gases by mid-1950. Pope Lawrence, director of the state division of industrial hygiene, commented that "the company has a fine installation for smoke control at the acid plant now under construction."

★Some 150 Utah, Idaho and Nevada mine operators met in mid-November in Salt Lake City to seek ways and means of speeding legislation to aid the western mining industry and to seek a revision of the tax structure for the industry.

W. H. H. Cranmer, president of the **New Park Mining Co.**, has been named chairman of a five-man group that will select a permanent committee to foster tax revision and mine legislation.

Other committee members are James E. Hogle, managing partner of J. A. Hogle Co., Salt Lake City; Cecil Fitch and Don Konnold, Utah representatives; W. R. New, Idaho, and W. F. Smith, Nevada.

Operators throughout the three-state area have been asked to nominate permanent members for the committee, which, when appointed, is directed to study the present mine industry tax structure and draw up a slate of suggested changes and modifications.

★Operations at the **New Park Mining Co.** properties at Keetley, only major mine open in the Park City Field, have climbed back to 95% of normal after the summer shutdown. Company President W. H. H. Cranmer reported operations continuing on the Pearl fissure, on a main heading, with high-grade, gold-bearing ore being mined.

A station is being cut on the 1,500-ft. level for another 900-ft. drift to the Pearl fissure to increase the production. This second drift is expected to cut the Galena-Mayflower fissure.

According to company spokesmen, the firm is concentrating on mining gold-bearing ores rather than lead-zinc high-grade due to the lead and zinc price situation.

Employees reportedly have borne out their promise to increase efficiency, resulting in a sizable increase in tons per man at New Park. Physical improvements recently put in place include a steel and concrete skip-pocket, costing an estimated $20,000.

WASHINGTON

★**Northwest Magnesite Co.'s** plant at Chewelah resumed operations Nov. 18, after a 27-day shutdown because of the steel strike. More than 300 men were reported back to work.

★**Meadow Creek Mining Co.**, with property in the San Poil district of Ferry County, has exposed a vein of copper-silver ore near the surface and is drifting on that vein with expectations of shipping ore to the smelter in the near future, according to Wayne Richards, Spokane, manager. Mr. Richards also reports cutting a 30-ft. wide vein of good milling grade in the adit crosscut, 400 ft. lower on the mountain.

★**Day Mines, Inc.** of Wallace, Idaho, reported successful small-scale development of low-grade gold ore at its property in the Republic district. A company director, however, said that a higher price for gold or lower operating costs would be necessary before the company could produce there on a large scale.

★**Lehigh Portland Cement Co.'s** ultra-modern change house for accommodation of 200 men at Metaline Falls, has been completed. It contains fluorescent lighting, lockers for 200, pre-heated dressing benches, and an electric precipitron for cleaning the air. The air is heated, forced into the rooms, then drawn through the lockers to dry the workers damp clothing.

★According to a U. S. Bureau of Mines report, pumice and pumicite sales in the State in 1948 were 26,675

tons valued at $47,787. Figures on the State's lead production were 7,147 tons in 1948, compared with 5,359 tons in 1947.

★The Institute of Technology, at Washington State College, Pullman, is making tests on the recovery of fluorine from monazite sand in Idaho, at the request of the AEC. This is a step in the production of the fission material, U-235. Experiments on beneficiation of low-grade uranium, and on development of crackproof walls of pumice blocks are being made, according to R. L. Albrook, research chemist.

Other experiments are being made with the sink-float process at the experiment station to test a method of profitably extracting lead-zinc from the low-grade ores of the Metaline district.

★Edward F. McTarnahan, Seattle, of Rotary Mills, Inc., demonstrated the portable ore milling plant which he has invented, in Spokane in November. The mill which he claims has made successful tests on thousands of tons of ore, is mounted on a 3½-ton truck. The 25-ton rotary type mill, including a 2-ton electric generator weighs 6 tons, compared to 15 to 18 tons of the conventional mill of the same output. Nine-inch manganese steel balls are driven around a 3-ft. saucer at 70 turns a minute, and Mr. McTarnahan claims the crushing force of the 108-lb. balls equals that of the 1,000-lb. balls in a gravity-type crushing plant. Only 27-hp. is required and he claims the plant can operate profitably on ore carrying values of only $4 to $6 a ton.

★**Howe Sound Co.'s** miners of the CIO Mine, Mill & Smelter Workers' local acted independently of the international union, and agreed to continue working at the Holden mine at the old wage scale. The two-year contract which was opened last June for wage negotiations expires June 1, 1950.

Lack of miners may delay operations of the Super Chrome Co., at its property near Bellingham, in Whatcom County. Forty hardrock miners were needed and only 12 had been found late in November. Operations were scheduled to begin about the first of the year.

★Foundation for the 200-ton mill is being put in at the property of **Eagle Mountain Mining Co.**, near Chewelah, according to Conrad Wolfle, manager. An electric trolley trammer has been purchased and will be operated in the 4,000-ft. tunnel next spring.

★Officers of Northwest Mining Association installed during the closing banquet of the Association's 55th annual convention on Dec. 3 are: Harold J. Hull, Wallace, mining attorney, president; E. C. Stephens, manager of Spokane office of Anaconda Copper Mining Co., vice president; E. K. Barnes, Spokane, re-elected treasurer, and Roger O. Oscarson, re-elected secretary.

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IN CANADA

• Labrador Iron Ore Development

• Leftists Capture B. C. Mine-Mill Union

★First announcement of definite plans for developing the Labrador iron-ore deposits was made Nov. 26 by Premier Smallwood of Newfoundland. He quoted Jules R. Timmins, president of the **Labrador Mining & Exploration Co.**, as authority for plans to start later in 1950 on a big project that would require up to $200 million by the end of 1952. An option to participate with Canadian interests in financing had been taken by a group of American Steel operators, who have formed the **Iron Ore Company of Canada.** Development work is to be done by **Hollinger-Hanna Ltd.**

Following is a breakdown of ownership in the option obtained by the Iron Ore Company of Canada:

Armco Steel 10%.

Republic Steel 20 to 25%.

Youngstown Sheet & Tube 20 to 25%.

Wheeling Steel 5%.

National Steel offered to take 50% but other companies will not permit such an arrangement.

This large-scale development is to employ an estimated 10,000 men, half of them to be brought in from Newfoundland. After completing the 360-mile railroad, annual output of 10 million tons is planned, later increasing to 20 million tons. Total requirements of Canadian steel mills are now running at about 5,500,000 tons a year and it is expected the main outlet for production will be the Atlantic seaboard between Boston and Baltimore. New support has been given the popular issue for building a Chignecto canal as a direct shipping route from the Gulf of St. Lawrence through the Bay of Fundy as a short cut saving several hundred miles for ore boats traveling to the New England coast. Trade Minister Howe recently pointed to iron-ore sources in Labrador as a factor requiring construction of the St. Lawrence seaway to allow access to steel mills in the Great Lakes area.

★The program of the Canadian Metal Mining Association for bringing Displaced Persons to work in Canadian mines has been completed and is not expected to be resumed unless a more active demand for workers develops. Since 1947 the association has moved 3,807 men to Canada for mine employment and an additional 3,000 immigrants secured mine jobs. Labor shortages which hampered production all through the war have been overcome primarily as a result of the arrival of the D.P.'s.

ONTARIO

★**Canadian Johns-Manville** has announced plans for putting its new asbestos property, located in Monroe township, into production next spring, rather than install a pilot mill as formerly reported. Initial mill rate will be 100 tons per hour, increasing to 200 tons and later to 400, equal to 3 million tons a year. The "A" orebody has been explored by diamond drilling and satisfactory manufacturing tests have proved the value of the short, hard, strong fibers for several important uses. Similar grades are now imported from Australia and Africa. The orebody has been traced for an average width of more than 500 ft. for a length of 2,700 ft., making it one of the major world sources of asbestos. Removal of overburden by bulldozers and dragline has encountered thicknesses up to 75 ft. Open-cut mining is planned to a depth of 300 ft., followed by underground mining down to 800 ft. The new mill, located a quarter mile to the west, had steelwork completed by the first of December. The five-story building is adequate for treating 200 tons per hour.

★At the Miller Lake-O'Brien mine, located in the old Gowganda silver camp, **Siscoe Metals Ltd.** has found indications of a new ore system. After drifting 300 ft. on a barren calcite vein high-grade silver ore came in and continued for the next 65 ft. To the south about 30 ft. is a parallel vein two sections of which returned 500 oz. silver each from drill cores. In the most easterly part of the property work on the 1,075-ft. level from the No. 11 winze opened 800 lineal ft. of ore and the vein system has not yet been completely developed. West of the No. 11 winze the old Flynn vein system has been partially reopened and search is being made for the unmined ore shoots that were indicated by drill holes put down below the 350-ft. level. Next spring it is planned to reopen old workings in the Bonsal and Millerette portions of the property. Silver recovery in October averaged about 27 oz. per ton for a profit of $18,000.

★**Hard Rock Gold Mines** reports an improved mill rate of 400 tons a day has made possible a $15,000 operating profit for the first nine months of 1949 compared with a loss in the same period of 1948 of $130,578, not including cost-aid. Last year the mine exhausted its sulfide ore and made the necessary mill changes to treat substantial reserves of low-grade free milling quartz. Average recovery in the first nine months of 1949 was $4.65 per ton and an attempt is being made to step up the mill to its 500-ton capacity. The zone of quartz stringers gives mining widths up to 30 ft. along a length of 1,100 ft.

QUEBEC

★**East Malartic Mines** reports that development is being concentrated on the 11th and 12th levels for the purpose of outlining the downward extension of the Sladen orebody. This

is located between the main ore zone and the west boundary. The downward extension of the main zone has been completely outlined by crosscutting and drifting on the new 11th and 12th levels from the No. 4 shaft. Drill holes have traced the extension of ore down to the 13th level. Production in the third quarter increased to 89,507 tons valued at $500,000, plus cost-aid credits which are estimated at $96,244.

★The Bachelor Lake property of **Dome Exploration Co.**, located 90 miles northeast of Amos, has built up improved mine-making chances as a result of detailed diamond drilling at 25-ft. intervals for a length of 375 ft. The average width of 21 ft. indicated 790 tons per vertical foot, the grade averaging 14 oz. silver per ton, 10% zinc, and 0.92% lead, for a total of $43.80 per ton. Additional drilling is planned along the remaining length of 325 ft. of the ore shoot and exploratory holes have picked up values for a length of 2,300 ft. along the main zone. The ore occurs in a band of rhyolite breccia and tuffs about 400 ft. south of a large body of gabbro. Dr. K. Watson is in charge of the drilling program.

★**Sullivan Consolidated Mines,** located northwest of Val d'Or adjoining the Siscoe mine, reports production averaging 525 tons daily, and the prospect that 1949 output will mark a new record in both gold recovery and tonnage treated since the mill started in 1932. Developed ore reserves are reported at more than a three-year supply. In the No. 2 shaft the two new levels at 1,900 and 2,000 ft. have been responding well to development and give promise of being the best in the mine. Gold recovery in 1948 averaged $7.59 per ton, which has been increased to $8.59 per ton (at $35 per ounce gold.)

NORTHWEST TERRITORIES

★**Giant Yellowknife Gold Mines Ltd.,** reports that in October 11,557 tons of ore were treated from its Great Slave Lake operations for a recovery of 6,308 oz. gold and 2,650 oz. silver, having a gross value of $245,007. Average recovery was $21.20 per ton, with average milling rate 373 tons daily. At the end of the month milling rate was increased to 400 tons, with operating costs cut to $12.38 per ton a reduction of $2.21 per ton since September. At end of October broken ore reserves totaled $475,224 tons, averaging 0.76 oz. gold per ton.

★**Golden Miller Mines Ltd.** is now carrying out diamond drilling at its Yellowknife property, a 12-claim gold prospect on the east shore of Vital Lake, MacKenzie district. The first four holes have been completed, but assay results are not yet available.

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BRITISH COLUMBIA

★The leftist faction, headed by Regional Director Harvey Murphy, has regained control of the B.C. district of International Union of Mine, Mill & Smelter Workers (CIO) with election of Ken Smith, of Britannia, as new president. Smith, former district secretary, defeated anti-Communist Claire Billingsley, of Trail, 1,761 votes to 1,642. There were 167 spoiled ballots.

The vote reversed an election last April in which Billingsley was chosen president and Smith defeated for secretary-treasurer, but which was declared void on a technical irregularity. Harvey Murphy and the B.C. union are under suspension by the Canadian Congress of Labor in its drive against Communists.

★In new union contracts at **Britannia Mining & Smelting Co.** and **Granby Consolidated** at Copper Mountain, the wage clause brings shift pay to $9.50 daily from $8.50 and eliminates a 75-c. shift bonus. Agreement with International Union of Mine, Mill & Smelter Workers is retroactive to Oct. 21 from the end of November for miners at Britannia, and to Nov. 5 for men at Copper Mountain. The Britannia agreement provides for six statutory holidays with pay, and a shorter work week in some underground sections. The Copper Mountain agreement calls for all Dominion statutory holidays (10) with pay, double time if worked.

★**Jersey** (Emerald Tungsten) lead-zinc property at Salmo, since its changeover to base metal production in March, until October this year has returned to the operating company, **Canadian Exploration Ltd.**, a total of $710,000 for lead-zinc concentrates. To Oct. 1 a surface and slushing operation produced 60,853 tons of ore grading 2.67% lead and 6.17% zinc. Profit to date, with one-half going to the Dominion Government towards the $950,000 price of the property, is about $256,577. Drilling program on the Jersey deposit has indicated ore reserves totaling 1,100,000 tons averaging 3.4% lead and 6.7% zinc. Meanwhile, Charles A. Banks, **Placer Development** chairman, said major repairs to the aerial tramway would boost output to 500 tons a day from a current 300. A major development program, including increase in concentrating and ore-handling facilities is anticipated.

★**Congress Gold Mines, Ltd.**, is undertaking capital reorganization to resume development of its Bridge River property. Shareholders have approved a reorganization on a one-for-four basis as a preliminary to provision of additional funds by **Sheep Creek Gold Mines, Ltd.** Sheep Creek has offered to take up 25,000 shares of Congress at 20c. per share in consideration of receiving an option on a further 475,000 shares at the same price.

★Custom ore shipments to **Consolidated Mining & Smelting Co.'s** Trail plant in the four-week period ending Nov. 19, totaled 11,778 tons, compared with 10,932 in the previous period. Lead shipments totaled 6,083 tons, compared with 6,246 tons in the previous period; zinc totaled 5,695 tons, compared with 4,686 previously.

★**Silver Standard Mines,** New Hazelton, reports discovery of gold-silver-lead-zinc ore in No. 6 vein which carries sampling value approximating $116 per ton. High-grade ore has been followed for 65 ft. at 1,300 elevation, with much of the material in the "bonanza" class. No. 6 is one of at least 18 known parallel veins within a zone 4,000 ft. wide. The ore was hit some 500 ft. below surface outcrops by a crosscut aimed at No. 7 vein some distance ahead. The new discovery will expedite the company's next objective, to block out sufficient ore to double mill capacity. Daily output has been about 60 tons.

★**Privateer Mine, Ltd.,** reports work has been suspended at the optioned Woodbury Creek operation near Ainsworth for the winter. During the short period of operation by Privateer, D. S. Tait, president, states about 150 ft. of tunnel was driven, of which 80% was in ore of good grade. From this work 700 tons of development ore were shipped to the nearby **Ainsworth Mining Co.** mill for treatment. Privateer plans to resume work on the property in the spring.

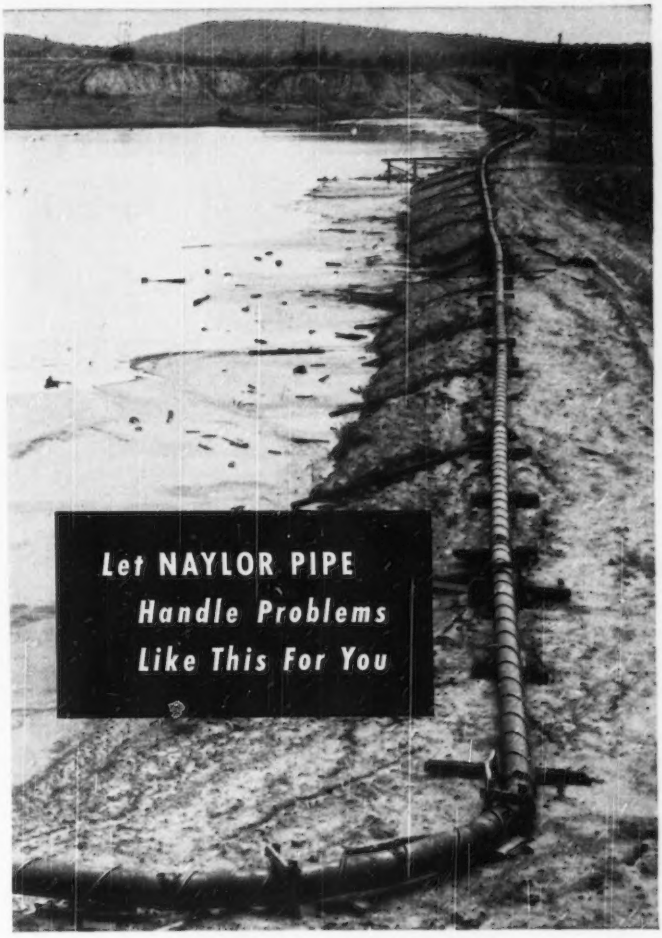
★**Rico Copper Mines, Ltd.,** plans to mine copper on a showing in the Cheam range bordering the Fraser Valley 90 miles from Vancouver. Plans call for trucking the ore to the Fraser River, where it would be loaded onto barges and shipped to Tacoma smelter. Ore is reported rich enough to ship without concentrating.

★**Santiago Mines, Ltd.,** reports an extension of the high-grade silver-lead vein, encountered on No. 755 sub-level east of the main shaft, has been disclosed and appears "very strong" in the west face of the sub-level of the Rosun mine at New Denver. Shipments from the east end gave smelter recoveries of more than $200 per ton in silver-lead.

★**Bell-Lucan Gold Mines** has been formed on the former Midway group, which is held under option about 25 miles southwest of Cranbrook. Principal values are in gold with low silver returns.

★**Consolidated Mining & Smelting Co.** announces it has begun production of rare indium, but no production figures yet have been disclosed. Large-scale operations have made it possible to refine indium from the minute quantities present in the ore. Company officials say they hope to broaden the field of utility for the metal through further research.

★A flood in the Similkameen River wrecked Tulameen Dredging Co.'s



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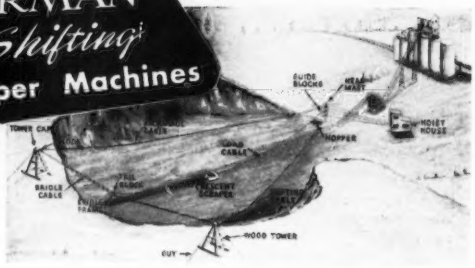

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British Columbia *(Continued)*

new suction-type $80,000 gold dredge at Princeton. Preliminary estimates were that $15,000 to $20,000 worth of gold was lost aboard the craft. The day of the wreck was to have been cleanup day, when dredging of two weeks would have been removed.

MANITOBA

★**Central Manitoba Mines, Ltd.,** in its annual report for the year, states that the company is carrying out further investigations of properties in Manitoba and Ontario. Diamond drill results on its large group of claims at Oswagan Lake in northern Manitoba were not encouraging. This group had been optioned to Canadian Nickel Co.

★**Sherritt Gordon Mines, Ltd.,** reports that earnings during the third quarter were somewhat higher, though production at Sherridon was maintained at approximately the same rate as in the previous quarter. During the nine-month period the company produced 14,476,294 lb. of copper, 3,962 oz. of gold, 130,815 oz. of silver and 7,655 tons of zinc concentrates. Net profit amounted to $1,153,774. Expenditures for the Lynn Lake development and other exploration amounted to $1,043,172. Two small stopes were opened up in the "A" orebody at Lynn Lake to maintain a supply of millfeed for the pilot mill.

The pilot mill operated more or less continuously throughout the period, treating a total of 2,245 tons of ore for a production of 288.6 tons of concentrate. The mill operation proved that a much higher ratio of concentration could be made than the previous mill operation at Sherridon had indicated.

★**San Antonio Gold Mines, Ltd.,** reports excellent results in development work on the 21st and 26th levels with no change in ore-bearing characteristics occurring in the deeper horizons. Establishment of ore on the 26th level has provided 1,350 ft. of vertical continuity of ore bearing extent. Work of a more detailed nature has had to be undertaken because of changes in the dip and rake of the lower ore zones.

YUKON

United Keno Hill Mines, Ltd., planned to increase its crew of underground workers in November. Approximately 10,000 tons of concentrates were shipped to outside smelters in 1949. The figure would have been larger except for the destruction by fire of the Elsa mill. The new mill was reported to be in operation in November. Rich new ore is said to have been located at the Calumet mine. A great asset to the district is the new road which will connect Mayo with Minto on the Yukon.

IN LATIN-AMERICA

- **More Money for Mexican Mining**
- **Gold Activity in Bolivia**

MEXICO

★National Bank of Mexico predicts stronger investment in mining in 1950. Improved business conditions and pegging of the dollar at 8.65 pesos will aid mining and other export lines. Mining men feel that prices abroad must improve to obtain benefit by the favorable dollar-peso rate, because of high wages and taxes.

It seems unlikely that the 15% ad valorem tax on exports will be lifted. In a recent trial, the supreme court ruled the levy constitutional. The Ministry of Finance claims it conserves dollars and helps consumers by limiting exports.

★Mine owners are worried about union pressure on legislators to kill a bill now before the legislature to modify the Agrarian Law and change the Labor Law.

★Two steel plants are planned to meet Mexico's increasing demand without increasing imports. They will be located at Saltillo, Coahuila and at Vera Cruz. Both will be Mexican owned and operated.

★Manuel Ramirez Vasquez, Labor Minister, has denied reports that the Government intends to start a special bank for miners' union fees, to keep them out of the hands, and pockets, of labor leaders.

★Experts hired by the union reported that **Real del Monte**, country's richest silver deposit, will exhaust its high-grade ore within 20 years. The union asked the Government to act now to safeguard Mexican miners from the 1969 crash.

★Secret service operatives and the army have been alerted at the port of Salina Cruz. Precautions are result of a tip that a Russian freighter booked to load bananas, would instead take on a cargo of rock from a recently discovered uranium deposit near Salina Cruz.

★The Labor Ministry is trying to end a strike by 100 employees at La Azul mine, for a 60% wage increase. Owner of the fluorspar property, Dr. Kiso Tsuru says low earnings make a pay raise impossible.

BOLIVIA

★Several improvements are being introduced in the design and operation of the sink-and-float plant of **Patiño Mines and Enterprises Consolidated (Inc.)** at Siglo XX.

This plant was originally designed to replace the hand sorting plant, using galena as the concentration media. From the start it proved effective in handling the declining grade of the tin ore from the mine, which in 1941 was 2.2%, and is now approximately 1.5%. Lately, the media has been changed to ferrosilicon, and last reports show that operation has considerably improved. With 1.56% heads, the feed to the mill runs 2.48, and in the process, more than 40% of the mine ore is eliminated as tailings running 0.35% tin.

The plant has a maximum daily capacity of about 6,000 tons. A new section will be added soon to preconcentrate the material from 2 mm. to ¼ in., which now goes together with other fines, directly from the mine to the mill.

★In Santiaguillo, near the village of Mancha, province of Chayanta, Potosi, a large deposit of wood-tin is being prospected under the direction of Dr. Jorge Pick of the Metallurgical Department of Potosi University.

★In the First Bolivian Congress of Engineering and Architecture, held in La Paz, Nov. 25 to Dec. 4, several resolutions relating to mining were approved. Outstanding among them were one recommending legislation to guarantee foreign investments in mining, and another asking the Government to conduct a nationwide geological survey.

★As an incentive to maintain the highest possible rate of tin ore exports, the Government has decreed a reduction in the forced sale of drafts for all output in excess of 32,000 tons per year. At the same time, the exchange for dollars resulting from such excess production was raised from Bs. 42 to Bs. 56.

In mining circles, little practical value is assigned to the measure, since tin prices have already gone so low, that it is very doubtful that Bolivian production, under present conditions of costs and taxes, can increase beyond the 32,000 ton mark.

★By official decree, the Bolivian Central Bank has been authorized to buy dollars resulting from the sale of gold, and from other minor sources, at the rate of the free exchange. Bolivian Mining Bank, another Government agency, has been authorized likewise to buy gold at the best price for the day in foreign markets.

As a result of these new conditions, gold mining has entered a period of great activity. Whereas before the decree, gold was sold at Bs. 78 per gram, producers now receive about

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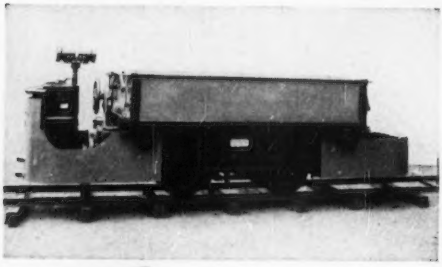

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Bolivia *(Continued)*

Bs. 160. Smuggling of gold for sale outside the country has sharply declined.

DUTCH GUIANA

★**Surinam Bauxite Co.** in Dutch Guiana will curtail production by approximately 25,000 tons a month due to slackening American demand.

COLOMBIA

★**Placer Development, Ltd.**, is considering installing a second dredge in operations of its subsidiary **Nechi Consolidated Dredging**, on Nechi River. Decision will be governed by success of No. 1 dredge which grossed $150,000 (U. S.) from Sept. 8 to Nov. 1, handling 590,000 cu. yds. of gravel, recovering 4,298 oz. fine gold. Including some areas of partially-drilled ground not yet fully proven, total indicated workable reserves approximate 300 million cu. yds.

★**Asnazu Gold Dredging, Ltd.**, operating on Upper Cauca River, reports production for nine months of 1949 to Sept. 30, was 3,799,100 cu. yd., recovering 17,226 oz. valued at $604,310.

IN AUSTRALIA

WESTERN AUSTRALIA

★Australian gold output for the eight months ended August was 0.88 percent higher than in the corresponding period last year, but was 43 percent below production in the eight months immediately preceding World War II. Western Australia accounted for 54,326 oz. of the total August production of 72,925 oz.

The Golden Mile, after the devaluation of sterling currencies, showed no evidence of a gold rush, except for some building activity to provide accommodation for several hundred immigrant mine workers. However, the mine offices were viewing the immediate future with optimism. The belief was fairly general that the 44% premium on gold production, a result of the recent slump in the pound-dollar exchange rate, would be increased sooner or later by a revaluation of the U. S. dollar in terms of gold. While the gold industry shares with other mining industries the general postwar shortages of labor and equipment, it has a greater incentive to bid for these scarce resources because profits from gold mining are tax-exempt.

The Department of Immigration has agreed to provide immediate shipping for 400 British miners who have been selected to work in the gold mines. Several drafts of Italian miners are also expected. Lake View & Star alone could immediately employ 500 immigrants from Britain. The company has converted the grandstand of the old Boulder racecourse into suitable accommodation.

With the new lease on life which gold mining has received from the higher domestic gold price, the time is thought opportune to secure new British capital for mine development. There is little hope that American capital will seek outlets for investment in Australia until the nettlesome double taxation problem has been solved. Though Western Australia cannot at present compete in assay values with South Africa, freedom from heavy taxation and England's desire to build up new overseas investments in food-supplying areas (to help pay for imports) may divert the heavy stream of English investments from South Africa to Australia.

★Stockholders of **Blue Spec Gold Mine N.L.** (in liquidation) have been asked to form a new company, to be known as **Blue Spec Mining Co. N.L.** It is expected that the mine could be back in production within six months of the recommencement of operations.

★**Wiluna Gold Corp., Ltd.**, incurred a loss of £7,329 stg. for the year ended March 31. However, Wiluna Gold Mines, Ltd., recorded a profit of £36,906 for the same period. The mine remained closed, but 167,465 tons of

calcined cyanide residues were treated for a recovery of 11,799 oz. Because of exhaustion of the stock of residues amenable to cyanidation, the retreatment plant was closed down at the beginning of May. Wiluna Gold Mines is controlled by Wiluna Gold Corp.

★**South Kalgurli Consolidated** closed its books for 1948-49 with a loss of £2,250 on mining operations, though there was a small profit from the sale of an investment. During the year 89,594 short tons of ore were treated. Net production was 19,441 oz.

★In the year ended June 30, **Hill 50 Gold Mine N. L.** made a profit of £25,300 (£28,782 in 1947-48) despite rising costs and a large expenditure on development. The mine treated 56,380 short tons for 13,616 oz. Capital expenditure included £15,449 on shaft sinking. The shaft is expected to reach a depth of 600 ft. by Christmas. Development expenditure took £17,718, and until orebodies between the 400 and 600-ft. levels are opened up costs will continue at this rate. Horizontal diamond drilling off the No. 6 level, as well as winzing and driving, have indicated the existence of considerable tonnages between these levels. High values have been disclosed between 600 and 800 ft. by a depressed diamond drill hole.

★**Lake View & Star, Ltd.,** earned £134,274 stg. for the year ended June 30, compared with £148,836 in 1947-48.

★**Central Norseman Gold Corp.** believes that drilling has indicated a substantial new orebody north of the ore now being developed in the Princess Royal mine. The drill hole intersected ore at 295 ft. for 70 in. with an assay of 270.3 dwt.

★The Minister of Mines has approved the grant of a temporary reserve of 280 acres to **Norseman Gold Mines N. L.** for six months. The reserve is located three miles out of Norseman and adjoins the western boundary of the leases which are being mined for pyrites by Central Norseman.

★The Department of Mines has been informed by the McIntyre Research Foundation that the use of aluminum therapy in Western Australia has been approved. Anticipating the approval, the department some time ago applied for an import license for the necessary apparatus and aluminum powder. As soon as the equipment is available, the therapy will be put into practice on the gold fields. Meanwhile, some mines are undertaking alterations to change houses to comply with the requirements.

SOUTH AUSTRALIA

★Iron ore shipments from Whyalla set a new record in October with 225,511 tons. September shipments were 167,320 tons. Because of direct and indirect strike interruptions, little ore had been mined since April.

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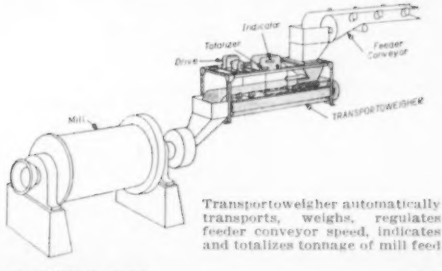

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E & M J REPORT

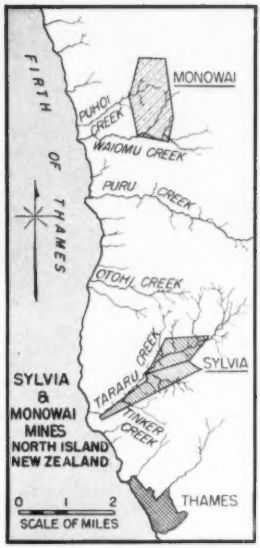
Two Ex-Gold Mines in New Zealand to be Reopened As Base Metal Producers

Foreign capital may be sought to develop two promising base metal properties in New Zealand if sufficient capital cannot be raised locally.

The two mines, the Sylvia and Monowai, are at opposite ends of a field extending from two to eight miles north of the Thames township on North Island. Except for Te Aroha, these are the only New Zealand mines which have shipped lead, copper and zinc concentrates in any quantity, although both were formerly considered as essentially gold properties. Good base metal assays at both mines have led to plans for their reopening by Sylvia Mines Consolidated, Ltd.

Ores are low-grade but carry a good gold-silver content. Total reef material is estimated to average about 10% sulphides (pyrite, galena, zinc-blende and copper pyrites) with traces of molybdenum, bismuth, antimony and tellurium. Galena is more prominent at the Sylvia end, while copper predominates at the Monowai. It is assumed that a very large tonnage of ore is available, running 2½ to 4% lead, 0.4 to 0.8% copper, and about 4% zinc. Gold assay may top 8 dwt. in the Sylvia section and 3 dwt. at Monowai. Rich intrusions could considerably improve the average. Silver is about three times the gold content.

Recent flotation tests have overcome earlier difficulties in handling the complex ore. Extractions on a collective float are 94.1% Au; 92.6% Ag; 91.4% Pb; 89.2% Cu; 95% Zn. Differential flotation of this ore offers small advantage. In computing values, zinc is ignored because of extractive difficulties.



Monowai is probably the better prospect for large scale mining. One reef has been traced for over a mile in the outcrop and picked up at underground points for 3,000 ft. Width of the reef where explored, averages 35 ft. with average backs of about 500 ft. above the adit level. The block is estimated to carry over 2,000,000 tons of ore worth $14 per ton at present metal prices.

In the Sylvia section, where the reef is narrower and has been almost worked out above the No. 4 level, deep mining will be necessary. A 450-ft. borehole put down from No. 4 level, gave very high values for gold and lead, proving that the reef persists in depth. However, core recovery was poor owing to the friable nature of the rock, and results are therefore viewed with some reserve. Further development will depend on satisfactory returns from pilot plant operation.

Sylvia Mines Consolidated, Ltd., intends to install two pilot flotation plants. One will treat 20,000 tons of ore from upstoped blocks already developed from the No. 4 adit level at the Sylvia mine. From various samples and test runs, this ore is expected to assay better than $22.00 per ton for precious and base metals, excluding zinc.

The other pilot plant will serve as a bulk tester for the Monowai reef. If trials are satisfactory, ore will be mined and treated on a large scale.

In the opinion of Mr. L. R. Heywood, consulting engineer for Sylvia Mines Consolidated, the area is the most important for lead and copper in New Zealand.

NORTHERN TERRITORY

★**Australian Development N. L.** reports that sufficient ore has been proved to keep the mill at Tennant Creek in full operation for at least four years on an average grade of 40 dwt. Accounts for the year ended June 30 disclose profit of £41,641. The company treated 3,726 tons for 9,677 oz. For every 100 oz. won, 28 oz. were left in the residue. A cyanide plant is being installed.

VICTORIA

★Victoria's gold yield is expected to increase considerably as a result of dredging to begin shortly on Jim Crow Creek, near Strangways. The dredge is being rushed to completion by **Central Victorian Dredging Co. N. L.**, an operating company of **Gold Mines of Australia, Ltd.** A second dredge, owned by the same company, is being assembled at Newstead.

The Jim Crow Creek dredge is a 1200-ton affair. Resoiling devices are attached to both dredges, to resoil the land as they pass through it, instead of leaving the desolate waste that characterized former dredging operations.

★**Maude & Yellow Girl Gold Mining N. L.** incurred a loss of £7,048 for the year ended June 30, contrasting with a profit of £3,992 in the preceding twelve months. The company will benefit from the local gold price rise by an additional £7,456 from gold carried on the books at the old exchange rate, but realized after revaluation. During the year 9,905 tons (12,360 in 1947-48) were crushed for 3,423 oz.

★**Argus Hill Chewton Gold N.L.** has unwatered the mine and resumed underground operations. The shaft had been sunk to 470 ft. and the main west crosscut extended to 236 ft. when a fire on August 22 put the plant out of action.

TASMANIA

★Record profit of £1,068,600 was struck by **Electrolytic Zinc Co. of Australasia, Ltd.**, for the year ended June 30. High overseas metal prices, increased price of Australian zinc from the end of 1948, and disposal of carry-overs of zinc concentrate and calcine purchased at lower prices in earlier years, were the principal factors contributing to the record profit.

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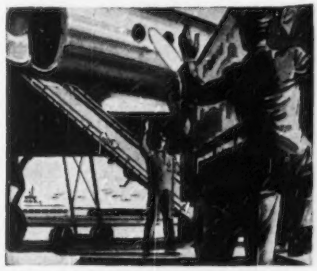

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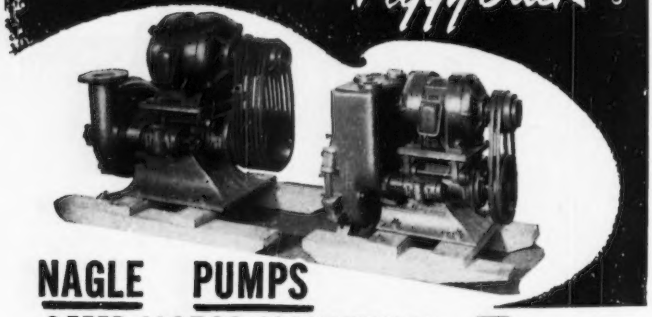

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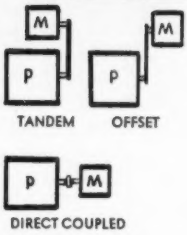

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Tasmania *(Continued)*

Zinc production at Risdon rose from 75,396 tons to 82,669 tons, also a record. Zinc sales in Australia represented 56 percent of the available tonnage, leaving only 44 percent for export. The disparity between the fixed domestic price and the international market price, though somewhat lessened since December 30, 1948, is claimed to have cost Electrolytic Zinc £3,000,000 in 1948-49.

At the company's West Coast mines 126,870 tons of ore were treated for 38,974 tons of zinc concentrates, 8,767 tons of lead concentrates and 3,107 tons of copper concentrates. These figures deviate very slightly from the returns for 1947-48.

The company produced 26,873 tons of sulphuric acid. Superphosphate output set a new record with 45,509 tons. As a further offshoot of the sulphuric acid project (which is based on the SO_2 in flue gases), Electrolytic Zinc has an ammonium sulphate project in hand. Shortages of materials, particularly steel, are likely to delay its completion.

★Ore treated by **Mount Lyell Mining & Railway Co., Ltd.** for the year to September 30 increased from 1,319,429 tons to 1,426,114 tons, but the larger tonnage will be reflected only in later smelting returns because no smelting coke was available in the June-September quarter due to strikes. Production of blister copper for nine months to June 30 totaled 3,871 tons, containing 3,840 tons of copper, 14,090 oz. of silver and 2,393 oz. of gold.

★Treating 155,389 tons in the 51 weeks ended October 22, **King Island Scheelite (1947), Ltd.** obtained 774 tons of Scheelite concentrates, compared with 592 tons in the preceding 52 weeks.

Zeehan Explorations, an offshoot of North Broken Hill and Broken Hill South, has struck a silver-lead lode in the old Oceana mine, at Zeehan, over which it has an option expiring December 31. The lode has been penetrated to a depth of 10 ft.

NEW SOUTH WALES

★Mr. M. H. Baillieu, chairman of the board of **North Broken Hill, Ltd.**, disclosed in his annual address to stockholders that North Broken Hill will spend this year £600,000 on new plant and £150,000 on development.

★**Broken Hill South, Ltd.** earned £1,375,198 in 1948-49, an increase of £458,952 over the previous year. Tonnage of sulphide and oxidized ore milled totaled 274,798.

The 1,200 employees of the mine received a total of £1,317,164 in wages, lead bonus, holiday bonus and other payments, an average of £1,170 per employee. (About $3,800 at the then prevailing rate of exchange.)

QUEENSLAND

★**Mount Isa Mines, Ltd.**, struck a profit of £1,457,337 for the year ended June 30 after charging £400,000 to depreciation, £788,377 to employee bonus payments and £1,030,000 to taxation. During the year the mines produced 2,886,410 oz. of silver, 38,547 tons of lead, 497 tons of copper, and the zinc equivalent of 23,907 tons in zinc concentrates. Estimated reserves of silver-lead-zinc ore at the end of the report year were 9,663,267 tons, of which 3,506,949 tons were developed ore while the balance was classed as prospective ore.

★Lower profit was earned by **Golden Plateau N.L.** for the year ended June 30. It was £16,587, compared with £21,697 a year earlier. Disclosures during the year on the No. 5 level at 664 ft. were considered to be very promising.

NEW GUINEA

★**Bulolo Gold Dredging, Ltd.**, reports its No. 5 dredge, one of two deep-digging dredges, capsized Nov. 22. A double caving of the digging face created a wave in the dredge pond, lifted and completely overturned it. Possibility of salvage is considered good. The dredge is insured for $1,200,000 (U.S.) and for overhead charges.

★**Bulolo Gold Dredging** had seven dredges in operation in October, handling 1,350,000 cu. yds. of gravel for a recovery of 7,387 fine oz. gold. Gravel reserves calculated at May 31, this year, were estimated at about 113,000,000 cu. yd., with 100 million carrying an estimated value of 20.83c. per yd. No. 1 dredge was permanently closed down July 28 when gravel for which it was designed was exhausted.

IN ASIA

PHILIPPINES

★**Benguet-Balatoc** production in November averaged 2,400 tons a day and is unlikely to increase until some decision is reached by the government regarding the production tax on ore. Officials of the Bureau of Mines are making an intensive study of the situation and have tentatively recommended a reduction in the rates as follows: on $5 ore, 70 percent reduction of the tax, on $10 ore, 50 percent reduction, on $15 ore, 30 percent, and on $20 ore and higher, 10 percent. This will be recommended to the House and Senate Committees. Be-

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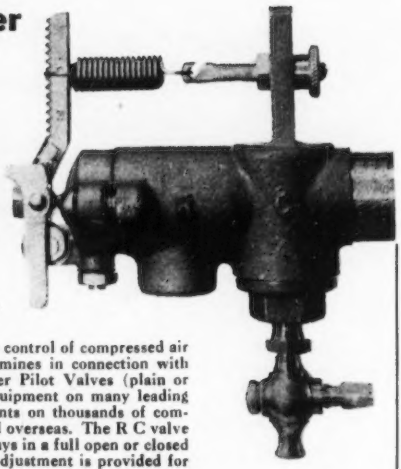

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Here is an ideal pilot valve for control of compressed air used so extensively in metal mines in connection with rock drills. The R-C Unloader Pilot Valves (plain or strainer type) are standard equipment on many leading compressors and as replacements on thousands of compressors both in the U.S.A. and overseas. The R C valve is positive in its action—is always in a full open or closed position and cannot chatter. Adjustment is provided for any unload-to-load range from 4 to 600 lb. Maximum pressure unloads.

Write for price and recommendation giving air pressure and range of load and unload operation desired.

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PILOT VALVES for Portable and Stationary Air Compressors provided with Unloaders

THE HARDINGE "ELECTRIC EAR" *is*

the only device of its kind that controls the feed rate in grinding mills by listening to the sound of the rotating load.

It compensates for changes in hardness, size of feed, etc.—producing a more uniform oversize, increasing mill capacity 10 to 20%, and freeing the operator for other duties. Ask for Bulletin 42-1.

"Keeps my ball mill up to snuff."

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Philippines *(Continued)*

cause of the critical condition of the government's finances there is some doubt if these recommendations will be accepted.

★**Mindanao Mother Lode** reported 8,200 tons milled in November, with recovery of $182,700 in gold at the statutory price. This indicates an average recovery of $22.25 per ton, highest for two years, and compares with $10.50 per ton a year ago.

★**Lepanto Consolidated** declared its first post-war dividend of ½ cent per share. Production is steady. Machinery for the increase in mill capacity to 1,000 tons a day is scheduled for delivery by January 1. It is believed that the mill will be operating at 1,000 tons by July, 1950. Production for the first 9 months of 1949 was valued as follows: copper, $1,436,000; gold, $806,000; silver, $49,000: total, $2,291,000. Gold was sold on the open market in Manila at prices varying from $44 to $54.75 per ounce. The present market is about $43.75 per ounce.

★**Consolidated Mines** declared a second 10 percent dividend on its stock. Operations on the big Masinloc chromite deposit have virtually ceased pending resumption of demand for the ore from the U. S. The Cagayan chromite mines, producing metallurgical ore, are stockpiling. Manganese ore on the other hand is in good demand. Bureau of Mines engineers have reported favorably on manganese deposits on Siquijor Island, where there was a large production prewar.

★Encouraging reports have been received from development work by **Panaminas, Inc.**, a subsidiary of **Ventures, Ltd.**, in the Davao area in Southern Mindanao. It is understood that this company has acquired all the mining interests of Elizalde & Company, in that field. Ira B. Joralemon recently made a professional examination of the property in Davao, as well as inspecting prospects in the Baguio field.

★Considerable concern is felt over effect of currency devaluation on sale of Philippine iron ore to Japan. No other buyers than the Japanese blast furnaces have ever been available to the Philippine iron mines, either before or after the war. In prewar years, Japan imported annually about 1,300,000 tons of high grade iron ore from the Philippines. Shipments have been made from the Larap deposit this year at the rate of 25-30,000 tons per month. Price received for the ore was about $7 per ton f.o.b. Larap, which was three times the prewar price. As the Philippine Republic is a hard money country, Japanese buyers are likely to turn to other sources of supply in soft-money areas for iron ore if available, where it can be obtained at substantial discounts in terms of dollars.

INDIA

★**Champion Reef Gold Mines of India, Ltd.,** yielded 52,604 fine ozs. of gold from 105,700 metric tons of ore, an increase of 2,330 fine ozs. over the previous year. Development work totaled 5,287 ft., of which 2,278 ft. was on payable ore of 37.3 inches average width and assaying 22.4 dwt. per metric ton. Reserves of payable ore at the end of 1948 were estimated at 548,834 metric tons.

One major job of the year was the continued stoping of the valuable Glen Ore shoot which has a vertical area of 55 acres. Special attention is being paid to the rockburst problem, and during the year 44,560 metric tons were used in pack-walling.

★**Ooregum Gold Mining Co. of India, Ltd.,** was a smaller but deeper operation, its report shows, with deepest point being at the foot of the auxiliary main winze 9,376 ft. vertically below field datum. Ooregum produced 97,118 metric tons of ore from which 28,618 fine ozs. of gold were extracted —2,508 fine ozs. more than the mine yielded the year before.

Development totaled 3,305 ft., of which 1,550 ft. was on pay lode averaging 25.2 inches wide and assaying 26.6 dwt. per metric ton. At year's end reserves were estimated at 147,614 metric tons of average grade 8.6 dwt. per metric ton.

Pack-walling activities in Ooregum used 18,734 metric tons of granite.

Meanwhile, the October 1949 production at the four mines yielded 14,627 fine ozs. of gold from 46,125 metric tons of ore. Mysore lead with 4,943 fine ozs., Champion Reef yielded 4,099, Nundydroog 3,554, and Ooregum 2,031.

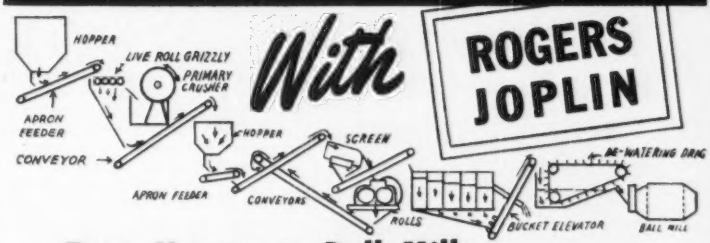
★Indian manganese exports to the U. S. are expected to fall slightly below the anticipated 400,000 metric tons target for 1949. Government figures show that in the first ten months of the year total exports were only slightly more than 500,000 metric tons, of which barely 300,000 went to America. Best export month was June when 89,000 metric tons were shipped.

A manganese mine disaster at Sangvem near Goa, Portugese India, cost the lives of 40 miners in November when a detonation in the area brought down the cutting under which they were working.

★Quarterly report of the **Indian Copper Corp., Ltd.,** for the period ended September 30, 1949, shows that 1,507 long tons of refined copper were produced from 93,514 short tons of ore treated. Of this 1,465 long tons were issued to the company's rolling mill which produced 2,169 long tons of rolled brass and 250 long tons of yellow metal circles.

★A deposit of more than 5,000 metric tons of highest grade plastic ball clay has been uncovered in Tumkur District, Mysore State, which when added to the ordinary china clay found very widely in the state yields a top quality of egg-shell white chinaware with high export value.

DRILL IT-LOAD IT-HOIST IT



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A completely co-ordinated chain of equipment in the production circuit means greater efficiency.

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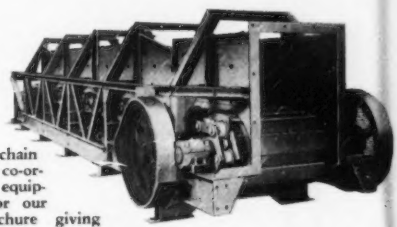

A link in the chain of completely co-ordinated mining equipment. Write for our illustrated brochure giving complete description and specifications.

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JAPAN

★Japanese gold production during 1949 will show an increase of about 20% over that of 1948. Present production averages 311 kg. of gold per month, indicating a probable output in excess of 3,700 kg. for the year. Last year's production was 3,036 kg. of gold, or a monthly average of 253 kg.

Japan's Natural Resources Board is preparing a five year plan aimed at boosting annual output to 10 metric tons. Mining companies are jointly asking for a raise in the price from the present level of Yen 385 per kg. to Yen 500 or Yen 600, and for an increase in the gold prospecting subsidies from Yen 14 million to Yen 500 million. With these two developments, they claim that production could be raised to 15 metric tons per year.

★**Furukawa Mining Co.** has temporarily shut-down its Nagamatsu copper smelter in order to economize on overall smelting costs. Copper concentrates from the Nagamatsu mine are being shipped to the company's main smelter at Ashio.

Having Trouble with Stubborn Materials?

Arching-over and plugging-up in bins, hoppers and chutes?

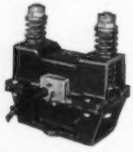
Then Apply the Proper Model

SYNTRON

"Pulsating Magnet"

ELECTRIC VIBRATOR

and watch the material flow!



Eliminate those tattle-tale sledge marks from your bins, hoppers and chutes—stop man-hour and production losses that originate with arching and plugging.

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IN AFRICA

SOUTH AFRICA

★To ensure production on a limited scale with the least possible delay **Doornfontein Gold Mining Co., Ltd.,** has decided to order equipment for a pilot plant with a monthly milling capacity of 10,000 tons to treat ore developed from the Annan shaft.

Reports of large tonnages of high-grade ore in the eastern part of the company's property, and the possible extension of the Carbon leader at depth are encouraging.

In the fiscal year ending June 30, sinking of No. 1 shaft was temporarily suspended to concentrate on the Annan shaft. Now that permanent winding equipment is operating, three shifts can be employed there. Temporary hoisting equipment will permit sinking No. 1 shaft another 1,000 ft. to a depth of 2,000 ft. The Annan shaft is expected to reach the Carbon leader at 4,300 ft., early in 1950.

★**Rustenburg Platinum Mines** has acquired the assets and liabilities of **Union Platinum Mining Co.** Earlier this year Union Platinum started production of 150 tons of ore per day. A plant to treat 500 tons a day was also started.

★**Vogelstruisbult Gold Mining Areas, Ltd.'s** elliptical shaft, sunk to 6,662 ft., is claimed to be the deepest single-lift shaft in the world.

NORTH AFRICA

★**The Economic Cooperation Administration** announced Dec. 9 that it has signed a contract with Newmont Mining Corp. involving advances of $3,600,000 in Marshall Plan funds for the modernization and expansion of the lead-zinc mines owned by the Societe des Mines de Zellidja, operating in French Morocco.

Zellidja proposes to spend about 3,670,009,000 francs ($10,500,000) of its own funds on the expansion program. Newmont Mining has been affiliated with Zellidja since Nov. 1, 1946.

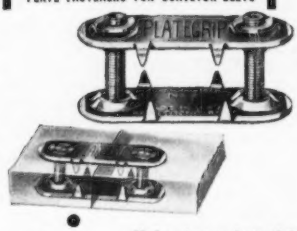
ECA funds involved in the deal will be repaid over a period of seven years by lead and zinc for the stockpile.

After the development program has been completed, it is expected that the mines' annual production of 85,000 and 120,000 tons of lead and zinc concentrates, respectively, will supply more than 70% of France's future lead requirements and about 50% of her zinc.

ECA, under its statute, is cooperating with governments of Marshall Plan countries in the development abroad of materials in which the United States' resources are deficient.

PLATEGRIP

PLATE FASTENERS FOR CONVEYOR BELTS



Make strong dust-tight, water-tight joints in belts of any width. Special design spreads tension uniformly across belt, allow natural troughing of belt and assures smooth operation over flat, crowned or take-up pulleys. Sizes for belts of from ¼" to 1½" thickness. *Write for Catalog Sheet.*

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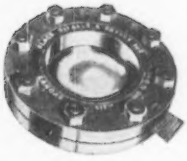
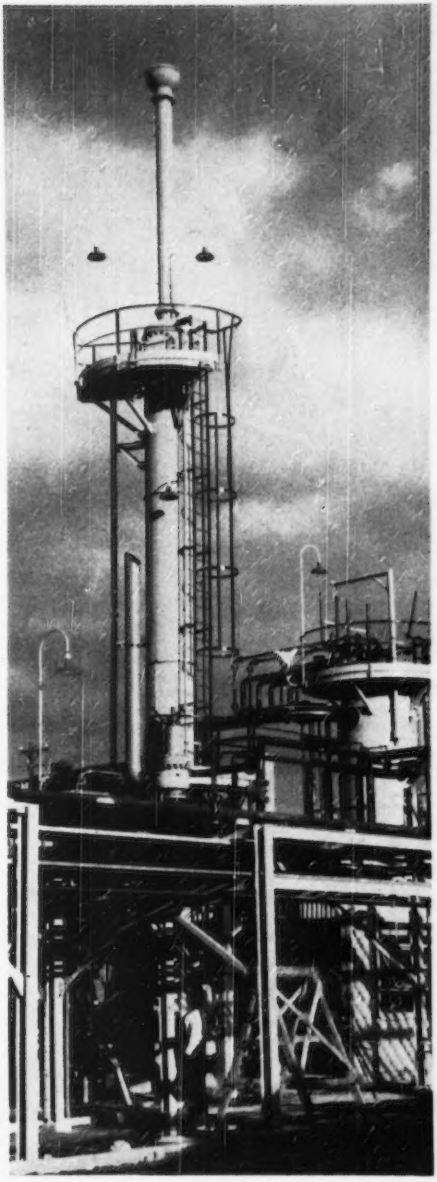


The BS&B Safety Head

Once again the experienced engineering staff and great production facilities of Black, Sivalls & Bryson are pioneering! BS&B-welded high-pressure piping in the Bureau of Mines' Hydrogenation Plant at Louisiana, Mo., is today in full operation, tested and approved for up to 15,000 psi pressure!

Seldom has there been a more severe taxing of welding strength and quality than that! Also, BS&B Pressure Vessels made to the plant's exacting specifications are in service at many points in this Coal-to-Oil pilot plant.

BS&B is proud of its contribution to such a notable experiment . . . producing petroleum from coal . . . and reminds you that these great BS&B facilities and products stand ready to assist you with *your* production problems!



Pictured at right, only a small part of this highly technical, specially designed plant.

Special Products Division, Section SPW9
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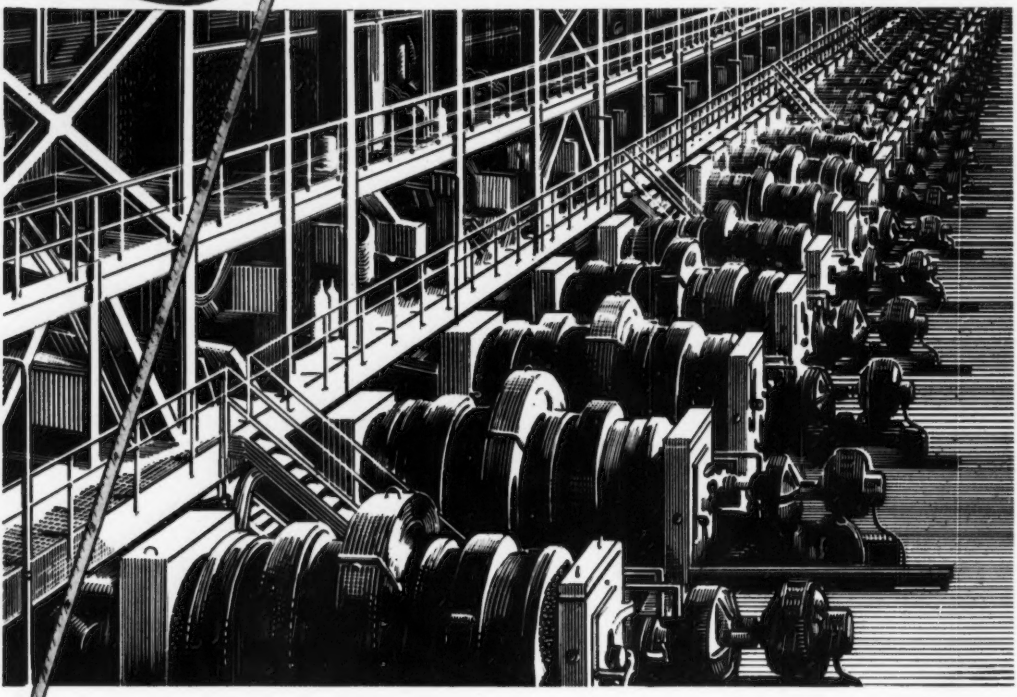
The pulp line in your grinding mill governs your milling capacity—the higher the pulp line, the lower the capacity. MARCY Low Pulp Line Open-End Mills give you the lowest pulp line and the highest capacity of any type mill available because the end product is removed near the periphery of the mill without excess overgrinding; the ball charge works at top efficiency and so does the driving motor. The increase in tonnage means lower per-ton costs in your grinding section.



Low Pulp Line Discharge is an exclusive MARCY feature. Our engineers can show you exactly why MARCY grinding may be expected to give these operational advantages for you:

1. **Increased tonnage, lower per-ton costs.**
2. **Low Pulp Line.**
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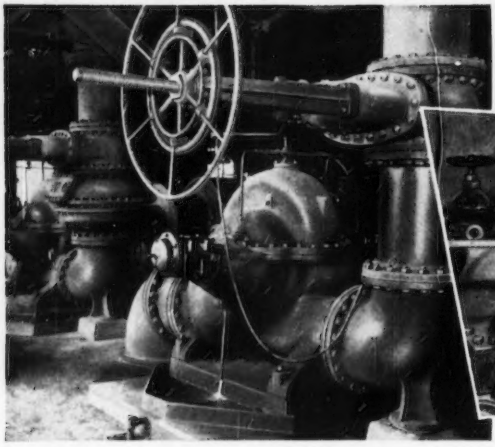
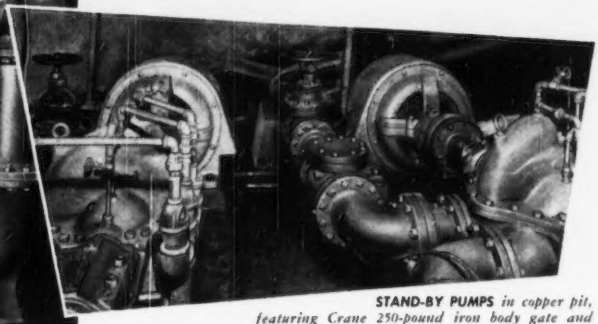
CONVEYOR BELTING



LOW PRESSURE WATER *circulating system in coal treating plant, equipped with Crane flanged and screwed piping equipment.*



STAND-BY PUMPS *in copper pit, featuring Crane 250-pound iron body gate and check valves in 8-in. lines.*

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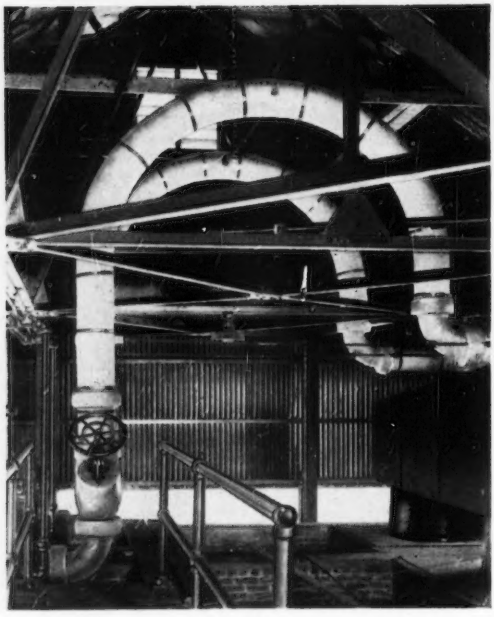

POWER PLANT *in a zinc mine, showing Crane fabricated steam header piping and Crane stop-check valves on boilers.*

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WITH P&H MAGNETORQUE*

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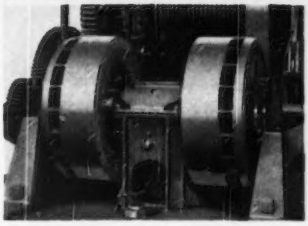

The P&H Magnetorque unit eliminates the ordinary swing assembly and all its troubles — transmits power electro-magnetically without friction, without mechanical wear. The Magnetorque lasts the life of the machine. Write for Bulletin X-104.

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The Fagergren Flotation Machine handles *more* tonnage with *less* power consumption . . .

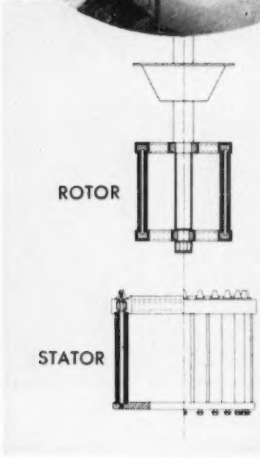
HIGHER SPEED OF FLOAT is accomplished by more intense aeration and shallower froth column. Hence, treatment time is reduced (by as much as 50%) and more *tonnage per hour* results.

GREATER RECOVERY of valuable mineral is assured by increased bubble formation and the thorough diffusion of finer bubbles. Alternate compression and expansion of the pulp as it passes through the rotor-stator causes intense aeration and agitation. This action provides more interfaces, and is essential to rapid, efficient mineral separation. The result is improved metallurgical efficiency.

LOWER POWER CONSUMPTION per ton of ore treated results from the level cell design of Fagergren machines, the shallow pulp column and high capacity. Unrestricted flow of pulp through cell units minimizes the power consumption.

THE FAGERGREN FLOTATION MACHINE, an exclusive WEMCO product, assures operators of *higher production* per cubic foot of cell volume at *lower cost.*

PROMPT SERVICE by experienced WEMCO field engineers and warehouse stocks of replacement parts are available through the WEMCO offices listed below.



The Rotor-Stator design of Fagergren machines, with two impellers and concentrated shearing zone, provides intense aeration and agitation. All wearing parts are rubber covered.

For full particulars, write the WEMCO office or agent nearest you

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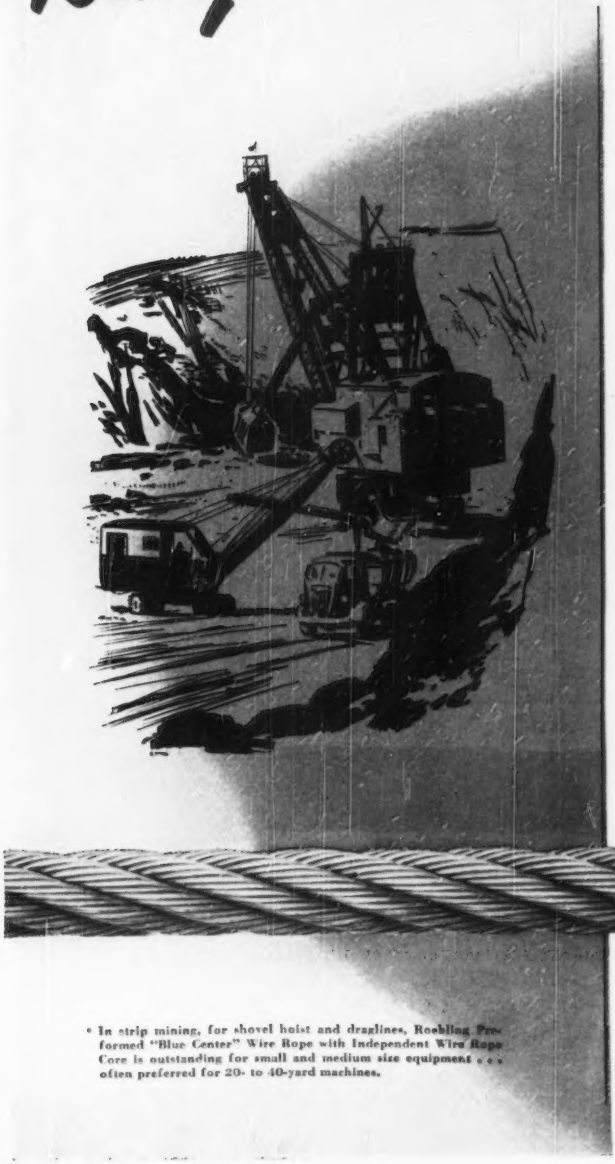

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THE RECORDS PROVE IT... that Roebling Preformed "Blue Center" Wire Rope stays on the job longer and cuts your costs. This is partly because "Blue Center" steel—developed and made only by Roebling—has unsurpassed resistance to abrasion, shock and fatigue. In large measure, too, it is because of the painstaking care, special techniques and modern precision machines that guard and maintain Roebling quality leadership.

Preformed a big help, too. Wide experience in the field proves that Roebling *Preforming* brings still more operating economies. Preformed is easier and faster to handle and install. You can cut it without seizing. It winds better... is not apt to set or kink... minimizes vibration and whipping.

Today's best buy. Roebling makes wire rope of every construction, grade and size ... engineered for top efficiency on every type and make of rope-rigged equipment. Have your Roebling Field Man recommend the *right* rope for best, low-cost performance on each installation. John A. Roebling's Sons Company, Trenton 2, N. J.

• In strip mining, for shovel hoist and draglines, Roebling Preformed "Blue Center" Wire Rope with Independent Wire Rope Core is outstanding for small and medium size equipment . . . often preferred for 20- to 40-yard machines.

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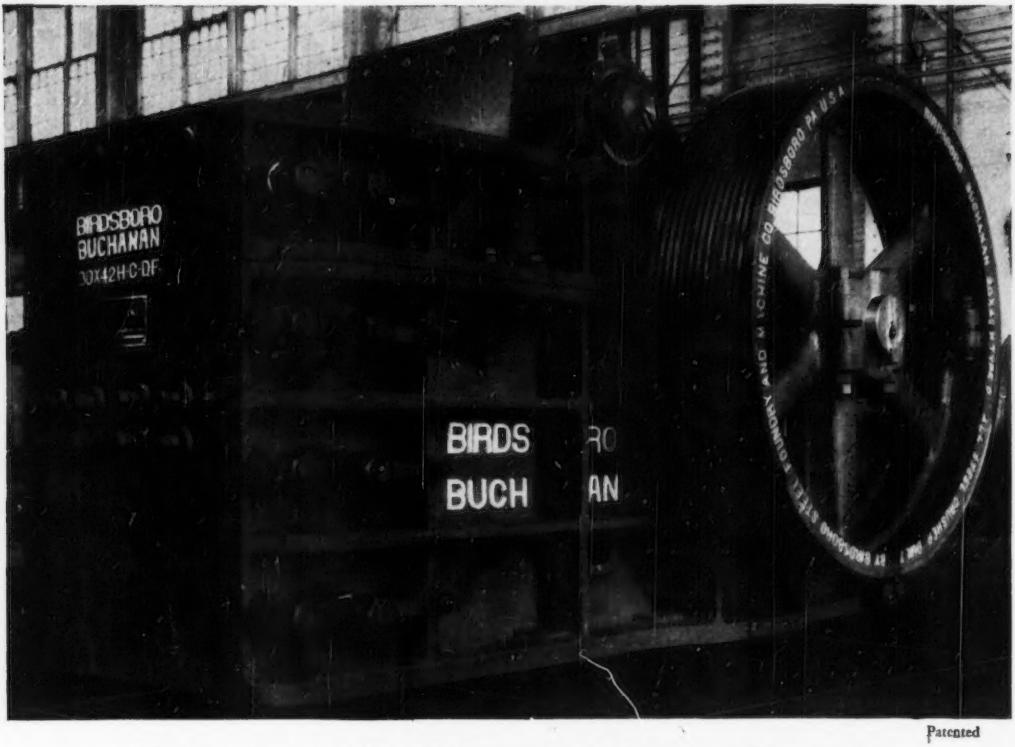
AN ALWAYS DEPENDABLE CRUSHER



Patented

This 30 x 42 H Type C Deep Frame BIRDSBORO-BUCHANAN JAW CRUSHER

No matter where you install Birdsboro-Buchanan crushers, above or below ground, you can *always* depend on a steady uninterrupted flow of crushed material.

This heavy duty All Cast Steel Crusher was specially sectionalized for underground installation in one of the leading ore producer's plants in the Iron Range where major underground repairs are impossible. The crusher must stand up to the job day in and day out. BIRDSBORO-BUCHANAN engineers have designed and built these crushers for dependable service.

Consult our engineers if you are up against a trying crushing problem.

BIRDSBORO STEEL FOUNDRY & MACHINE COMPANY • BIRDSBORO, PA.

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BIRDSBORO
BUCHANAN JAW CRUSHERS

CR-5-49

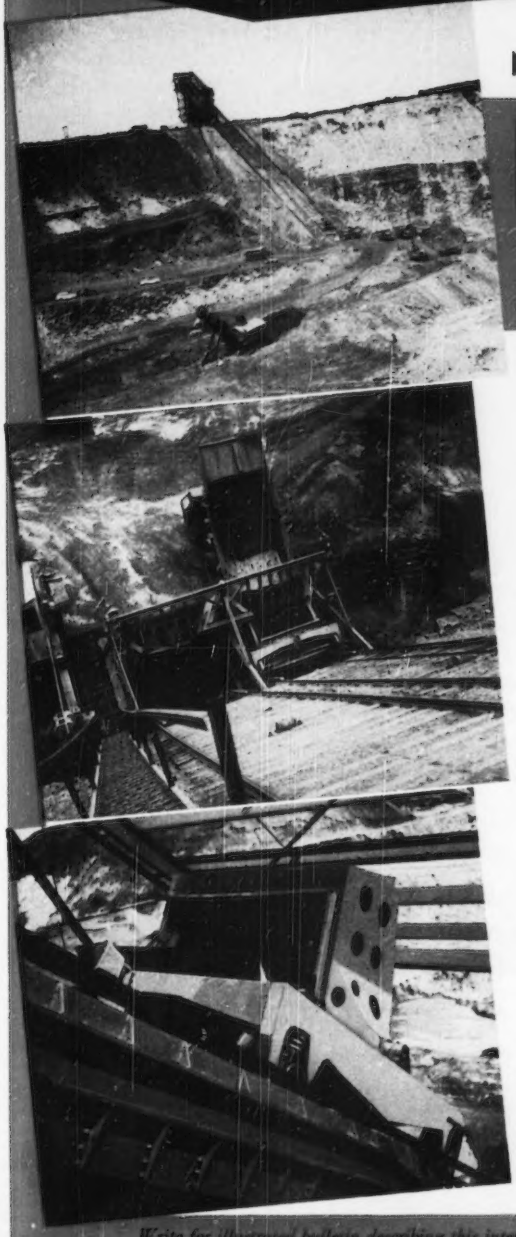
Direct from Pit to Surface

with

NATIONAL IRON COMPANY'S

ROCKOVER *Skips*

PATENTS PENDING



★ ***The Economical Method of Handling Materials From Mine or Quarry***

An improved method which eliminates long, expensive hauls. Trucks operate on bottom level of pit only, exchanging load for load with skips.

Skip is carried on trunnions at the center of the load, so that chassis never leaves straight track for dumping and hoisting cable always pulls straight without deflection.

The balanced skips each carry a full truckload of any size material from boulders down. Upper skip dumps automatically without positioning, while lower skip is being spotted for loading. Loading pocket is easily disassembled and set up in lower position as the skipway is lengthened. Track, 10 feet wide, laid on pit wall at any angle and according to standard track laying practices.

NATIONAL IRON COMPANY

Ramsey Street at 50th Avenue West
DULUTH, MINNESOTA

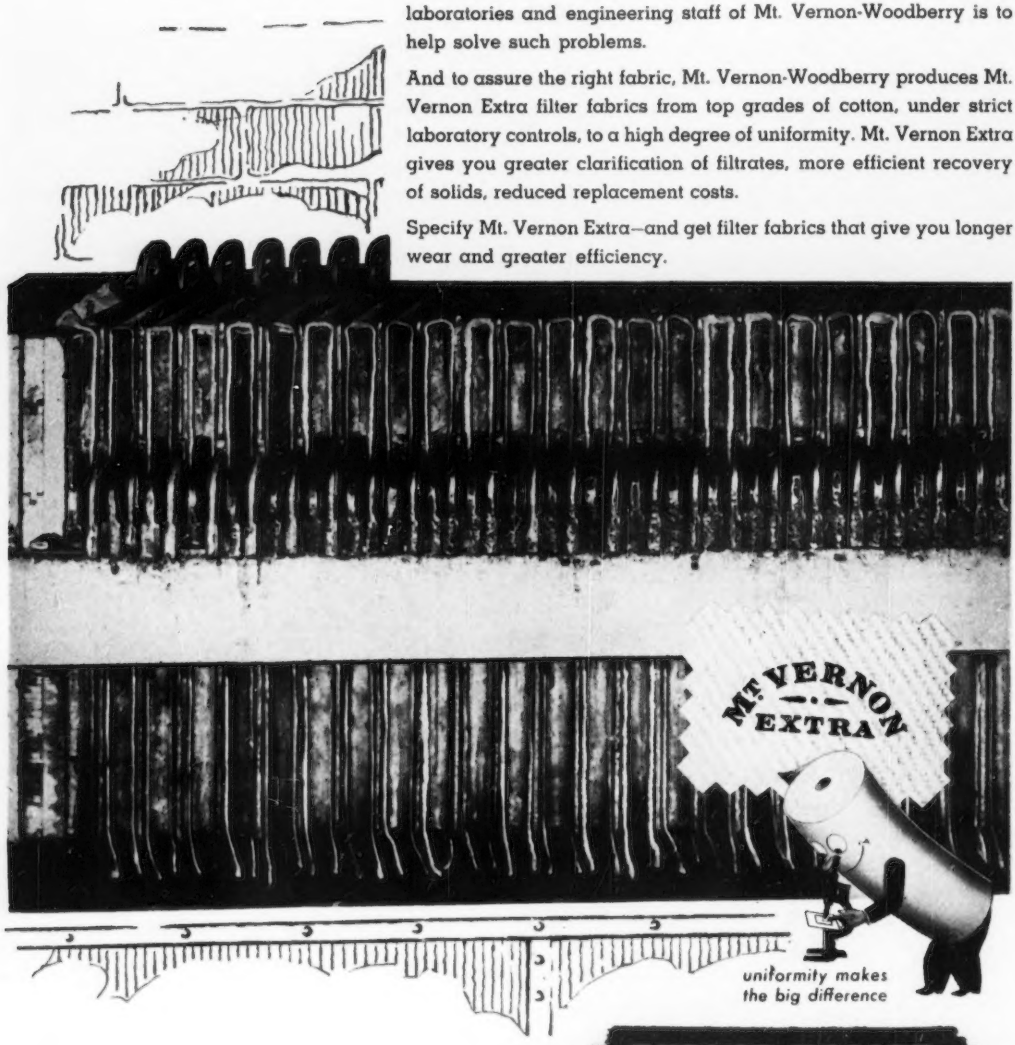
Write for illustrated bulletin describing this interesting, improved method of open pit mining.

Filter Fabrics that Fill the Bill ...Mt. Vernon Extra

There are few filtering problems that won't yield to a sound engineering approach and the right fabric. One of the functions of the laboratories and engineering staff of Mt. Vernon-Woodberry is to help solve such problems.

And to assure the right fabric, Mt. Vernon-Woodberry produces Mt. Vernon Extra filter fabrics from top grades of cotton, under strict laboratory controls, to a high degree of uniformity. Mt. Vernon Extra gives you greater clarification of filtrates, more efficient recovery of solids, reduced replacement costs.

Specify Mt. Vernon Extra—and get filter fabrics that give you longer wear and greater efficiency.



uniformity makes the big difference

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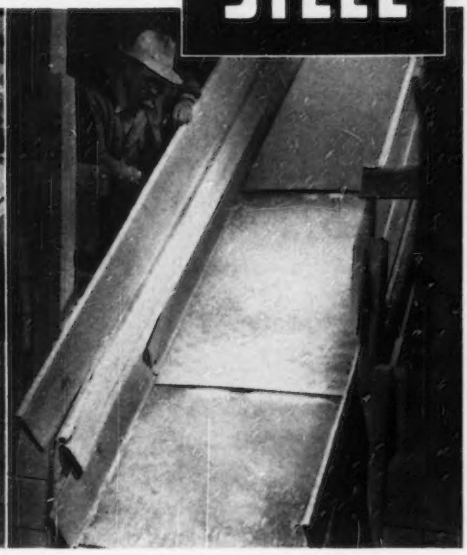
CHUTE COSTS CUT 66% AT STUART M. PERRY COMPANY WITH J&L JALLOY HEAT-TREATED STEEL PLATES

J&L STEEL

In Perry's primary crusher J&L heat-treated JALLOY plates lasted ten times longer than mild steel under a daily pounding by 700 to 800 tons of blue limestone.



Shaker tailing chutes receive severe sliding abrasion. 3/16" J&L plates lasted 22 weeks in this application—7 times service life of mild steel.

Lower Maintenance . . . Longer Service Life Result in the exclusive use of J&L JALLOY on all chutes at stone crushing plant.

The Stuart M. Perry Company, quarrymen, of Winchester, Va., has turned to J&L JALLOY heat-treated steel to provide more efficient chute liners. Perry found that JALLOY plates last four to twenty times longer than mild steel.

The result—"JALLOY steel has cut my chute costs by two thirds." That's what Thurman Perry, supervisor of the Stuart M. Perry Company, had to say about the JALLOY steel he ordered from William G. Wetherall, Inc., Baltimore, Md.

But more specifically here's how J&L JALLOY reduced Perry's maintenance costs:

• Used as a grisley plate in the primary crusher—JALLOY lasted 5 months—10 times longer than mild steel—Saved 44 man hours per JALLOY installation.

• As the bottom chute in a 3 ft. Symons Cone Crusher—JALLOY was still in operation after 16½ months—four times the life of mild steel.

• As the head chute from the bucket elevator—JALLOY lasted 16 months—20 times the life of mild steel—Saved 80 man hours labor.

• As a shaker tailing chute—JALLOY lasted 5 months—7 times longer than mild steel—Saved 72 man hours labor.

J&L heat-treated JALLOY, a fine grained, manganese-moly steel, has a yield strength of 160,000 lbs. per sq. inch and a Brinell hardness of 341 to 388. It is available in the form of bars and in plates up to 72" wide and 20' long, with thicknesses from 3/16" to 1½".

Although twice the price of mild steel, JALLOY'S long life saves money in applications where impact and abrasion are severe such as: conveyors, crushers, scrapers, bulldozers, power shovel buckets, dump cars, and heavy-duty truck bodies.

Write for the booklet "JALLOY—For Longer Wear . . . Less Repair." It contains information on properties, heat-treating and the workability of this *modern* steel. The coupon is for your convenience.

Jones & Laughlin Steel Corporation
412 Jones & Laughlin Building
Pittsburgh 30, Pa.

Please send me your data booklet: "JALLOY—For Longer Wear . . . Less Repair."

NAME _____

COMPANY _____

ADDRESS _____

Do you recommend J&L JALLOY Steel for: _____

JONES & LAUGHLIN STEEL CORPORATION

From its own raw materials, J&L manufactures a full line of carbon steel products, as well as certain products in OTISCOLOY *and* JALLOY *(hi-tensile steels).*

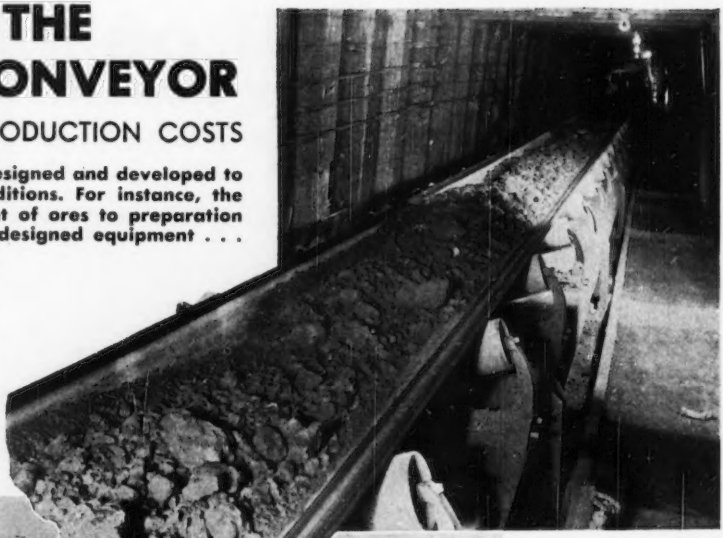
PRINCIPAL PRODUCTS: HOT ROLLED AND COLD FINISHED BARS AND SHAPES • STRUCTURAL SHAPES • HOT AND COLD ROLLED STRIP AND SHEETS • TUBULAR, WIRE AND TIN MILL PRODUCTS • "PRECISIONBILT" WIRE ROPE • COAL CHEMICALS

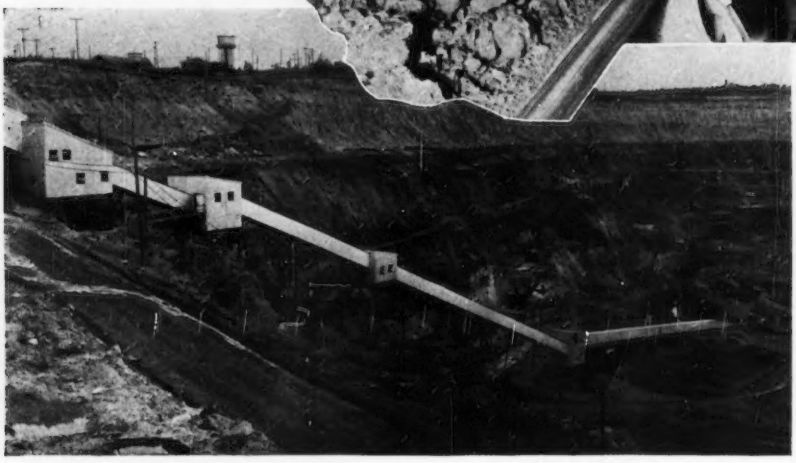
REMEMBER THE BELT CONVEYOR

. . . TO CUT PRODUCTION COSTS

Jeffrey belt conveyors are designed and developed to meet specific operating conditions. For instance, the quick, dependable movement of ores to preparation plants requires sturdy, well-designed equipment . . . the kind that Jeffrey builds!

The variety of uses for Jeffrey conveyors, bucket elevators, feeders, screens and electric vibrating equipment in metal mining is almost unlimited. For a well organized handling system . . . consult Jeffrey first.





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Coolers
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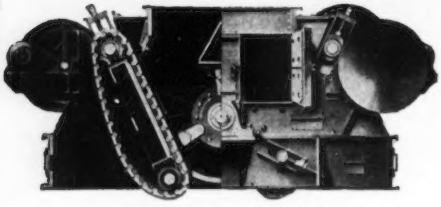
Dryers
Fans and Blowers
Feeders
Locomotives
Magnetic Separators
Pulverizers
Screens



Cross-section view of Reversible Traveling Breaker Plate Crusher

ABOVE — Jeffrey belt conveyor system handling ore direct from mine to processing plant. Here is non-stop production at its best.

LEFT — Jeffrey Mud Hog Swing Hammer Crusher with Traveling Breaker Plate being used to break down ore at this same metal mine . . . 42" x 50", this machine accommodates a feed of about 40 inches square by 18 inches thick. Send for data.

A complete line of mining, material handling and processing equipment

THE JEFFREY MANUFACTURING CO.

(Established in 1877)

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Birmingham 3	Cincinnati 2	Harlan	Milwaukee 2	St. Louis 1
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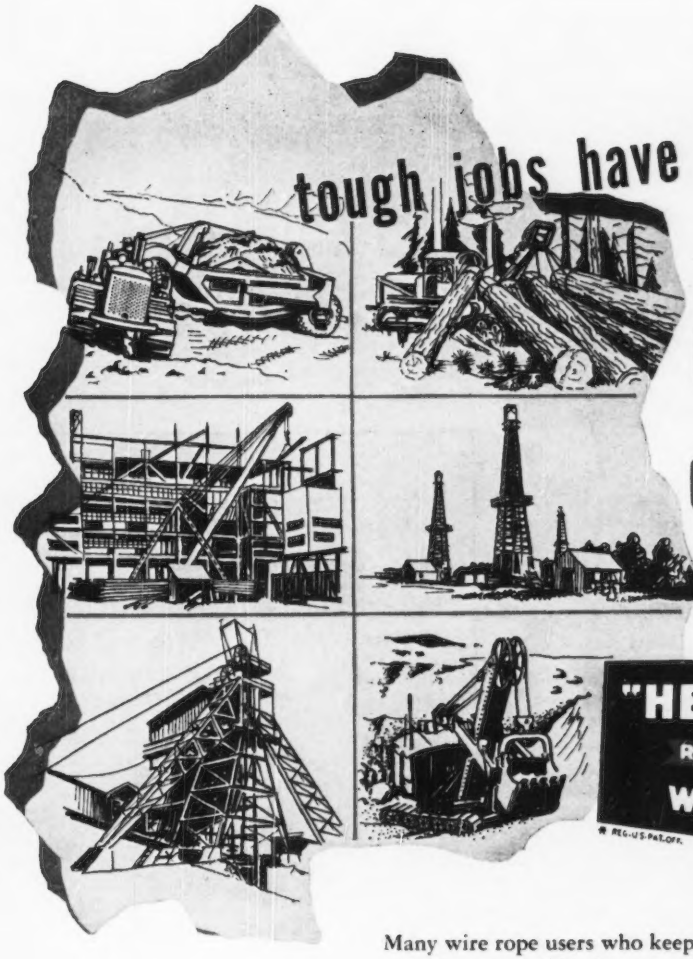
CANADIAN WORKS: JEFFREY MFG. CO., LTD., MONTREAL



tough jobs have long been the PROVING GROUNDS for "HERCULES"

RED-STRAND WIRE ROPE

★ REG. U.S. PAT. OFF.

Many wire rope users who keep an eye on their operating costs have proved by the accurate yardstick of performance that "HERCULES" (Red-Strand) Wire Rope provides longer wear . . . faster and more *continuous* work . . . increased profit.

Such results are never a matter of chance; definite policies involving materials, manufacturing methods, equipment and experience, insure them.

Made in Round Strand and Flattened Strand constructions, Preformed or Non-Preformed; there is a correct type for every purpose.

MADE ONLY BY

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Cost PER TON OF ORE MILLED Cut 57%

...WITH NI-HARD LINERS

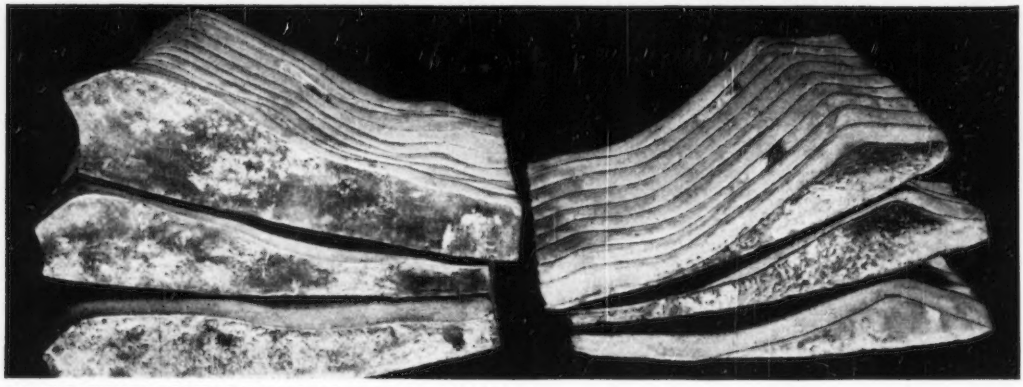
See for yourself why Ni-Hard* cuts cost...

Read the tabulated data...then look at the Ni-Hard liners photographed below (left) with those of manganese steel (right) after a test at one of Ontario's largest gold mines. Both kinds of liners, installed in the same 9' x 7' grate discharge mill using 3" balls, served under identical conditions...but those of manganese steel were worn almost to the shell, while the Ni-Hard liners were good for much further use at completion of the test.

Save labor and cut maintenance as well as operating costs by using Ni-Hard, a nickel-chromium white cast iron, for parts subject to wear and abrasion. *Reg. U. S. Pat. Off.

	NI-HARD	Manganese Steel
Weight when put in...	1426 lbs.	1356 lbs.
Weight when taken out	898 lbs.	435 lbs.
Weight loss	528 lbs.	925 lbs.
Percentage loss	37%	68.2%
Days in use.....	539 days	539 days
Cost per ton of ore milled	.52c	1.22c

NI-HARD MANGANESE STEEL



The International Nickel Company, Inc.
Dept. ME, 67 Wall St., New York 5, N. Y.

Please send me booklets entitled: *"Engineering Properties and Applications of Ni-Hard"* and *"Buyers Guide for Ni-Hard Castings"*

Name ..... *Title* .....

Company .....

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← **GET FULL INFORMATION**

Two booklets are yours for the asking. One gives engineering properties and applications...the other lists producers of Ni-Hard castings. Mail the coupon now.

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Profit by these advantages!

exclusive with Mack Six-Wheelers

A Mack six-wheeler on your hauling job brings you profit-building advantages offered by no other make of truck—advantages that mean outstanding performance and economy.

Power Divider—Positive traction regardless of terrain

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Maximum Flexibility—No chassis distortion

Self Steering—No tire scuffing

Uniform Tire Loading—Longer tire life

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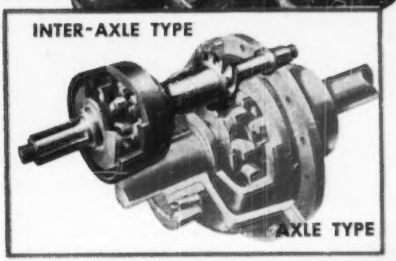
No weight transfer between axles

No bogie hopping, rearing or toe-stubbing

Simplicity of Design—No adjustments—Minimum maintenance.

Mack BALANCED BOGIE

Balanced Bogie—designed and built exclusively by Mack for Mack six-wheelers.



Mack Power Divider—exclusive in the Mack Balanced Bogie.

For full information on Mack's Balanced Bogie and exclusive Power Divider—what they can mean to you in trouble-free, uninterrupted schedules; in lower costs and increased profits—see your nearest Mack branch or dealer.

IT'S PART OF THE LANGUAGE

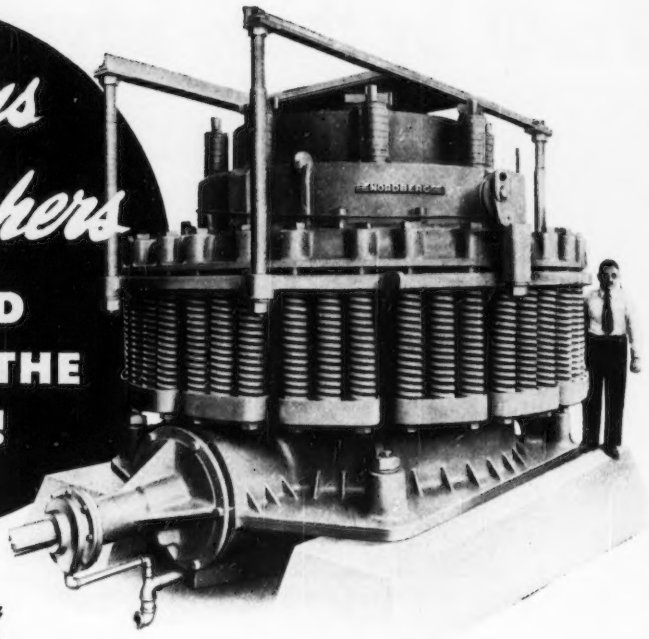
"Built Like a Mack Truck"

7609

Mack Trucks, Inc., Empire State Building, New York 1, New York. Factories at Allentown, Pa.; Plainfield, N. J.; New Brunswick, N. J.; Long Island City, N.Y. Factory branches and dealers in all principal cities for service and parts. In Canada: Mack Trucks of Canada, Limited.

Symons Cone Crushers

ARE USED ALL OVER THE WORLD!



Here are just a few reasons why!

● *Symons Cone Crushers control their feed automatically!* The feed distributor provides an even flow of material around the entire crushing cavity . . . insuring a correct rate of feed for maximum production.

● *The crushing action of Symons Cone Crushers* differs from all conventional types of gyratory crushers by combining smashing impact, high speed and wide throw . . . timed against gravity to

PRODUCE GREATER QUANTITIES OF FINELY SIZED PRODUCTS, WITHIN CLOSER CONTROL LIMITS, WITH TROUBLE FREE OPERATION

SYMONS Cone Crushers are available in three types — Standard, Short Head and Intermediate —in a wide range of sizes to fit your requirements. Other Nordberg machinery for the mining industry includes: Primary jaw and gyratory crushers, grizzlies, screens, grinding mills, feeders, hoists and Diesel engines.

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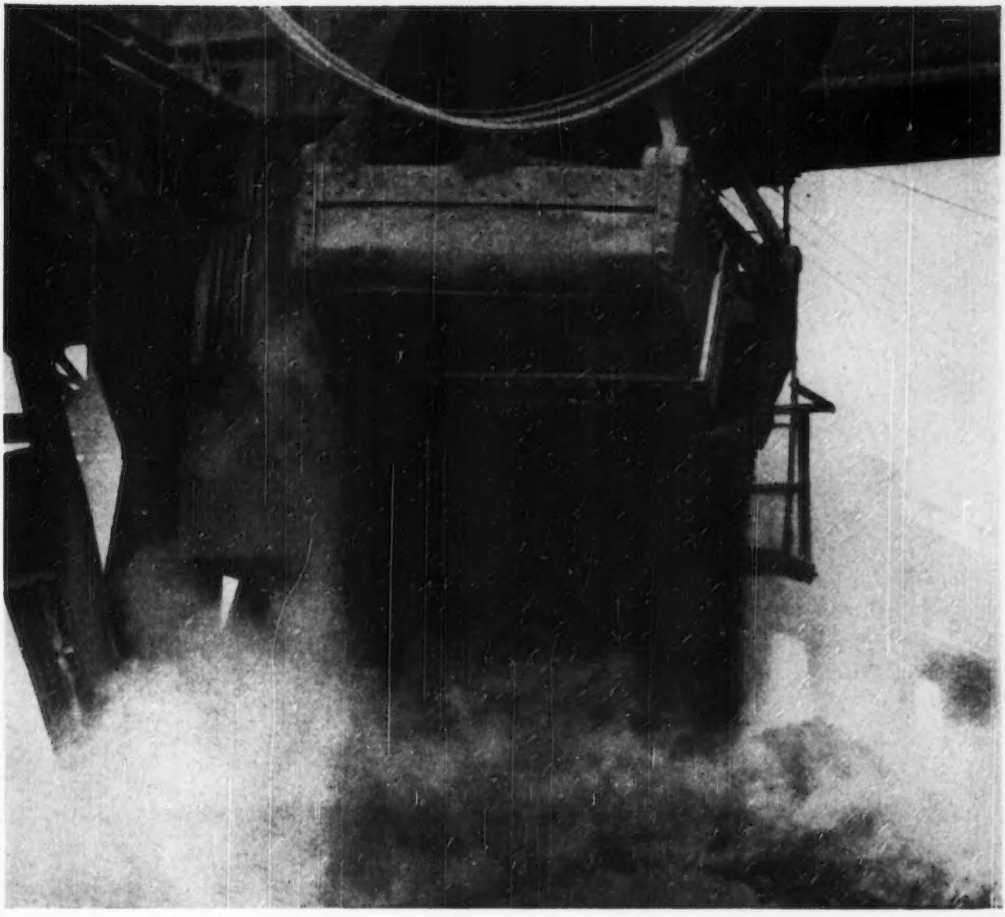
NORDBERG MACHINERY

M501

NORDBERG

Machinery for processing ores and industrial minerals



Who said "WORN OUT"?

Life begins with Stoody Self-Hardening 21

The low-cost alloy for all-around bucket protection

Exceptional Abrasion Resistance
Good Impact Qualities
Unmatched Burn-Off Speed
AC-DC Application*
No Slag Interference
Wide Amperage Latitude
Bonds Readily to Manganese Steels, Cast Iron and Common Steels

*Bare Stoody Self-Hardening 21 goes down faster and handles as easily as coated rods with DC equipment—in fact many welders prefer it!

For overall bucket protection, on lips, teeth, runners, bucket sides and bottoms, use Stoody Self-Hardening **21.** Try 50 lbs. on your next order. Available from any Stoody Dealer. *Write for literature and copy of Stoody Hard-Facing Guidebook.*

STOODY *Alloys*

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11940 East Slauson Avenue, Whittier, California

BALLMILLS

WET OR DRY GRINDING

•

OPEN OR CLOSED CIRCUIT

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ALSO AIR SWEPT FOR GRINDING AND DRYING

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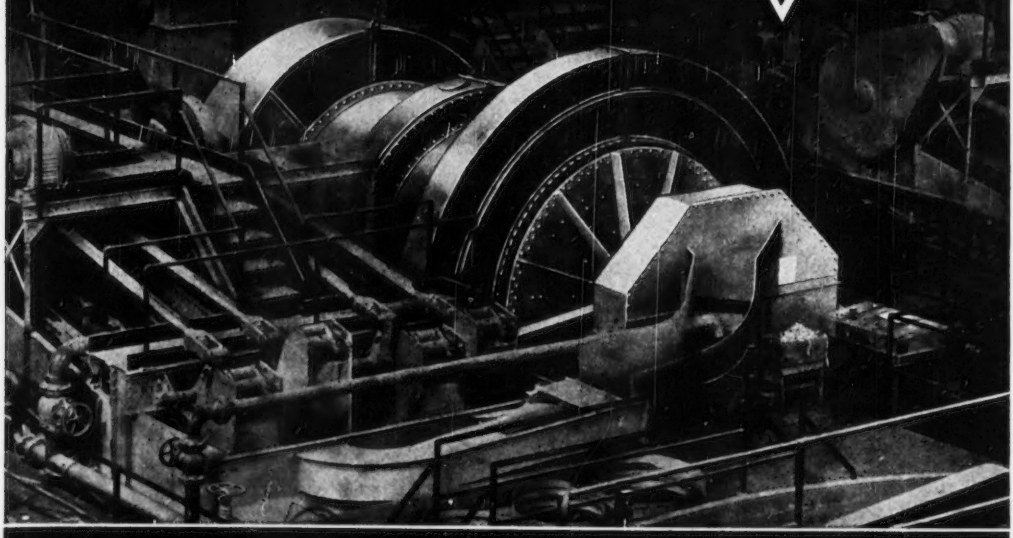

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NEW YORK, N. Y.

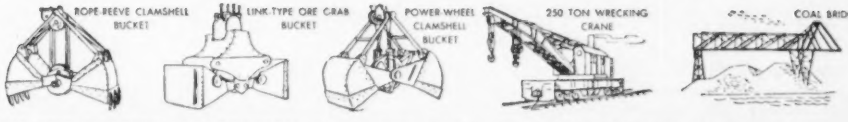
Check this list of Brownhoist features... when you're thinking of a diesel electric locomotive-crane

- ✓ Travel power applied direct to axles by 2 oversize inside hung spring-mounted motors
- ✓ Motor current supplied from generator direct connected to Diesel engine
- ✓ Travel speeds up to 15 MPH. for heavy duty switching service
- ✓ Helical gear reducer transmits power for hoist drums, swing, and boom
- ✓ Double disc roller bearing mounted rotating clutches
- ✓ Electric swing available at extra cost
- ✓ Cast steel rotating bed insures rigidity and permanent alignment of machinery
- ✓ Monitor-type cab provides 360° visibility
- ✓ 14" safety clearance between car body and rotating bed
- ✓ Roller bearings at all essential points

CAPACITIES 30 TONS AND UP

Only in the new Brownhoist Diesel Electric Locomotive-Crane can you check affirmative throughout this list of features that mean faster, safer, easier and more economical materials handling and car switching. Why accept less when it costs no more! Be sure you get the *best* when you invest.

BROWNHOIST BUILDS BETTER CRANES



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At right is the Chemico field office at Muscle Shoals where nitrate was produced during World War I. Above is the Construction Administration Area of the Jayhawk Ordnance Works, a Chemico World War II project.

"Experience
is the surest standard by which to test" WASHINGTON

CERTAINLY George Washington's yardstick of experience can be used to evaluate a business organization. It's the "surest standard", in fact, when you entrust responsibility for the design and construction of a heavy chemical plant.

Chemico is long on this valuable experience. Its record of building profitable plants goes back to 1914. Chemico played a vital role in two world wars . . . aided the development and expansion of industry throughout the world in times of peace.

During the past 36 years, Chemico has pioneered in the development of new and improved processes for the recovery and production of sulfuric acid and the production of nitric acid, synthetic ammonia and other heavy chemicals. Today, Chemico enjoys an international reputation in the field of chemical plant design.

This broad experience is the basic reason why Chemico-built plants deliver their full capacity year in and year out . . . why they operate at high efficiency with a minimum manpower requirement . . . why they have proved to be profitable investments.

If you are planning to build a heavy chemical plant or remodel an old one, entrust the project to Chemico—the firm with the widest and longest experience.

Typical Chemico Undertakings

PLANTS FOR PRODUCTION OF

SYNTHETIC AMMONIA
SYNTHETIC METHANOL
DOUBLE SUPERPHOSPHATE
AMMONIUM PHOSPHATE
AMMONIUM SULFATE
AMMONIUM NITRATE
CALCIUM NITRATE
FORMALIN

PLANTS FOR PRODUCTION, CONCENTRATION AND RECOVERY OF

HYDROCHLORIC ACID
NITRIC ACID
PHOSPHORIC ACID
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CHEMICAL CONSTRUCTION CORPORATION

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Chemico plants are profitable investments

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A fully convertible machine in the 1 yard class—shovel, crane, clamshell, dragline, hoe.

NEW! 2 SHOVEL BOOMS
All-welded 19 and 21 ft. lengths. Square—heavy duty dipper sticks.

NEW! AIR CONTROLS
Air power steering and air control of tread lock from operator's cab.

NEW! 4 CRAWLERS
4 chain drive crawlers available — 11 to 14 ft. long; 9'8" to 13' wide. Driving mechanism, oil enclosed.

NEW! SHOE CLUTCHES
Wider, full-floating anchor type Shoe Clutches for swinging—faster response; longer life.

NEW! HYDRAULIC COUPLING
No engine stall; shocks can't reach machinery. Smooth, flexible, vibrationless power.

Yes, on the new Lorain-50 the hydraulic coupling (fluid clutch) power-take-off is standard equipment, at no extra cost! — In operation this means (1) the engine can't be stalled under any digging conditions; (2) digging impacts and stresses are absorbed before they reach the operating mechanism . . . And the Lorain-50 brings you many other NEW features, in addition to those shown . . . Your Thew-Lorain distributor has the complete story ready for you — today!

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THEW LORAIN®

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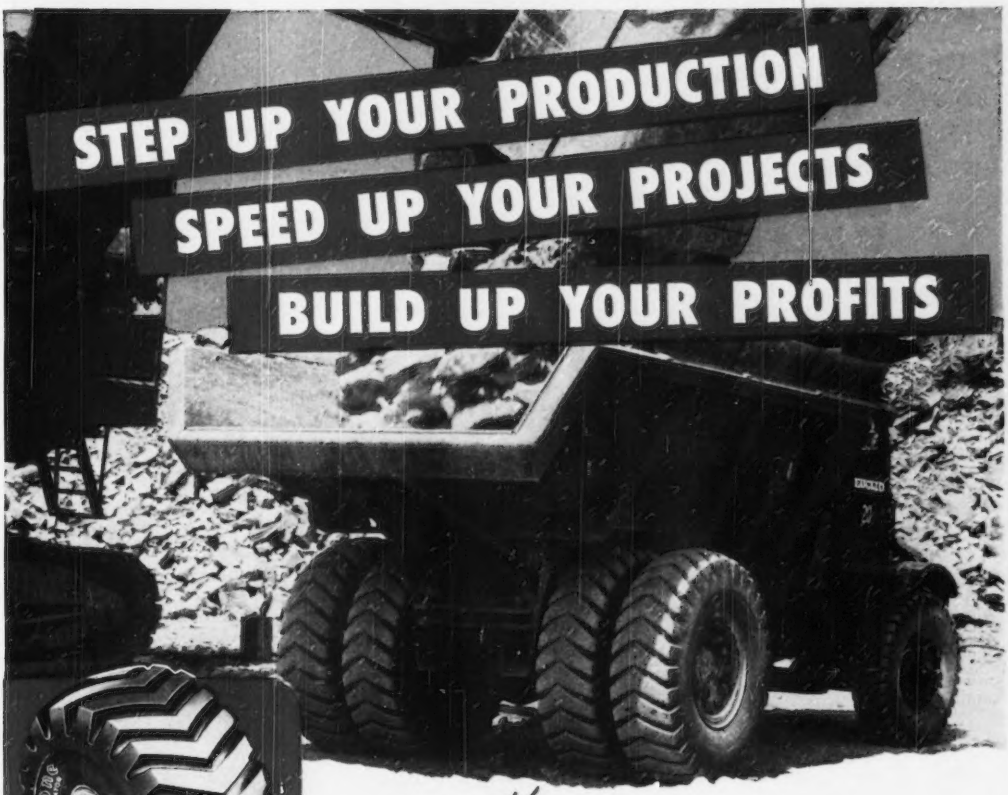
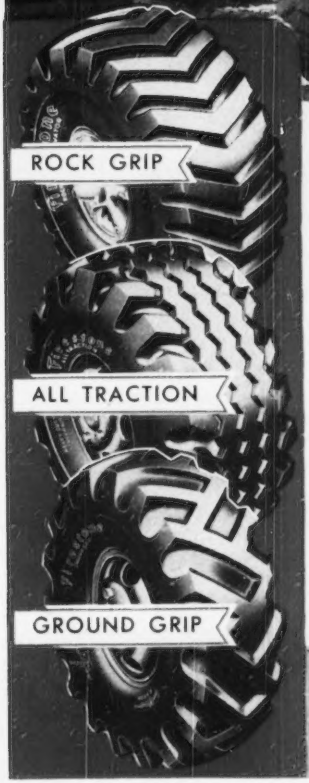
HOES • MOTO-CRANES

LORAIN 50 SERIES





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WHEN you're racing against time, there's nothing more costly than tire trouble. When tires go down, costs go up — and fast! There are just two means of relieving these tire headaches: one is through better tires, and the other is through better tire service. Firestone offers both.

Firestone tires are precisely engineered, both in body construction and in tread pattern, for your job. The cut-resistant treads are extra thick and extra tough. The bodies, armored by four "punch-protector" plies and double-thick sidewalls, are made of heavy, high-tensile, low-stretch, Gum-Dipped cords.

Your Firestone representative will recommend the right tires for your job, and will follow through and see that you get every dime's worth of built-in extra value. Let him prove it.

Listen to the Voice of Firestone every Monday evening over NBC

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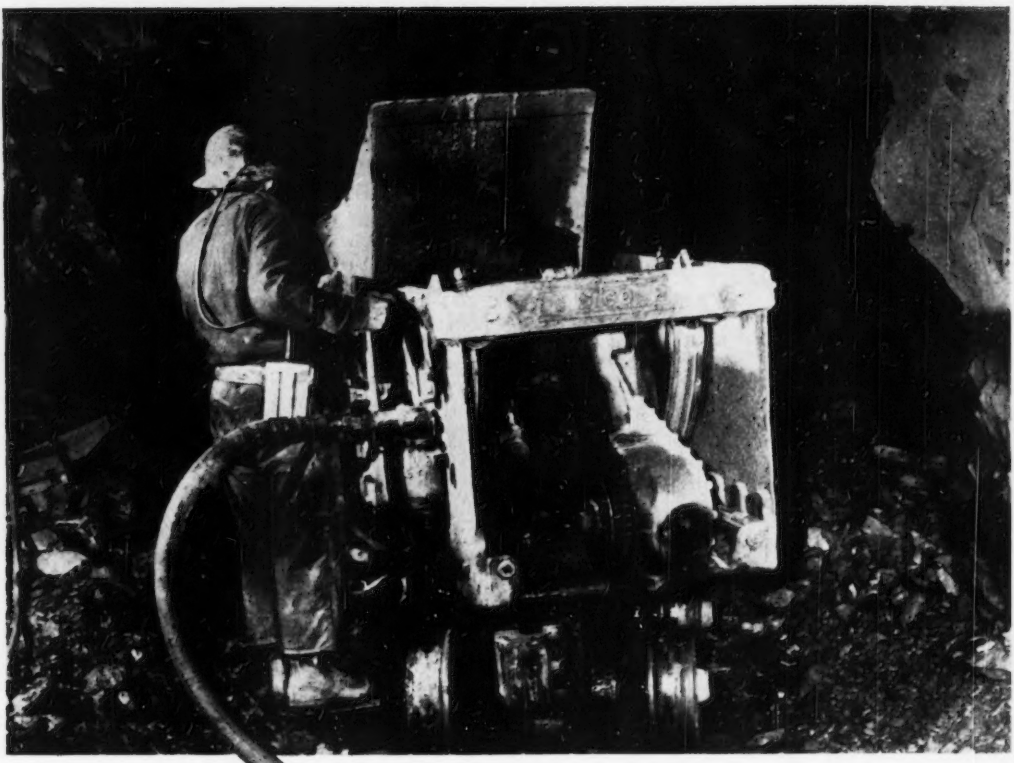
WHEN YOU BUY REPLACEMENT TIRES OR NEW EQUIPMENT INSIST ON FIRESTONE OFF-THE-HIGHWAY TIRES



Republic Air Hose establishes preference for underground iron mine work

● One of the world's largest iron mines recently voted Republic Champion the best available air hose for use with underground power loaders. Selection was made after a series of tests proved it outperformed all other competing hose.

Republic Rubber and its Duluth Distributor, the MacAskill-Monaghan Company, recommended Champion Air Hose for this work because it is ruggedly built and withstands the most abusive operating conditions.

Champion is a flexible hose of great strength, having exceptional resistance to pulsating and high working pressures. Special high tensile cord encloses the oil-resistant Reprene tube and a thick, highly resilient, low gravity, tan cover protects the hose against abrasion and shock. Champion is also available with a yellow safety cover that makes it plainly visible even in underground operations.

Mr. W. K. MacAskill, President
MacAskill-Monaghan Company
Duluth, Minnesota

Republic Rubber makes 840 different types of hose for every need. Like Champion, each is designed to give longer service life per dollar invested.

Consult your nearby Republic Distributor today. He can help you select the very best hose for your particular need.

Remember, Republic Rubber has been *the* specialist in the mechanical rubber goods field for more than 48 years.

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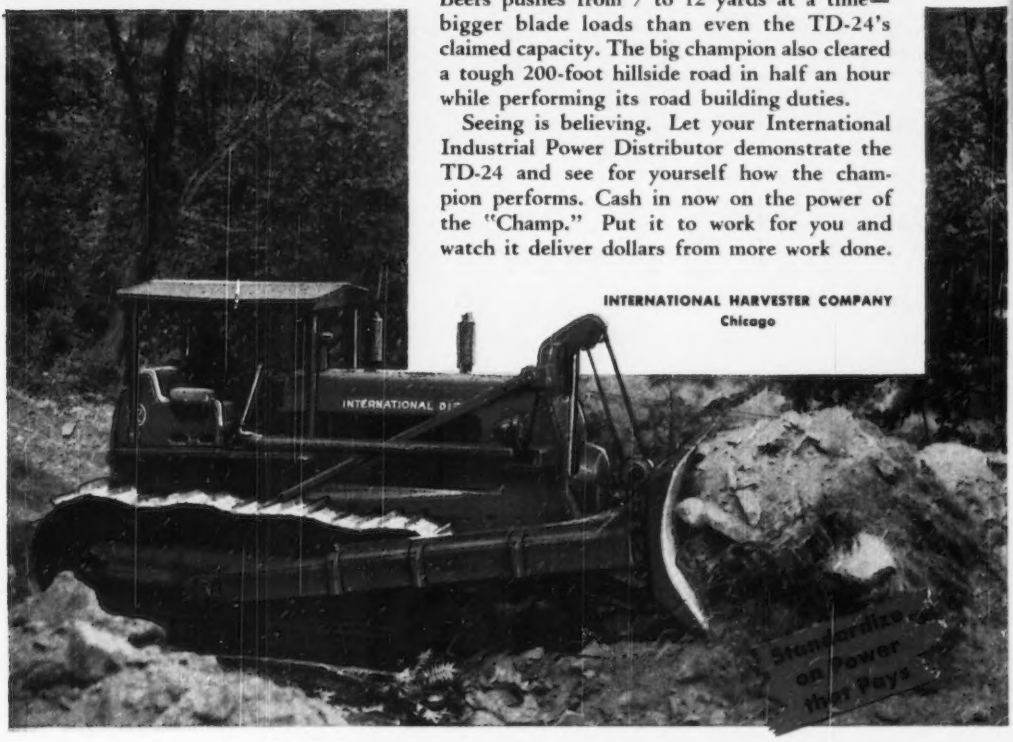
Champion OF 'EM ALL!

When the International TD-24 climbs into the production ring, its power plus features found in no other crawler, pay off in dollars. The champion packs the winning punch when the going is toughest.

J. H. Beers of Bangor, Pa., found that his TD-24 does the work of two competitive big tractors. This TD-24 works with a big shovel in strip mining operations and according to Beers pushes from 7 to 12 yards at a time—bigger blade loads than even the TD-24's claimed capacity. The big champion also cleared a tough 200-foot hillside road in half an hour while performing its road building duties.

Seeing is believing. Let your International Industrial Power Distributor demonstrate the TD-24 and see for yourself how the champion performs. Cash in now on the power of the "Champ." Put it to work for you and watch it deliver dollars from more work done.

INTERNATIONAL HARVESTER COMPANY
Chicago



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INTERNATIONAL HARVESTER

INTERNATIONAL INDUSTRIAL POWER

America finds a new, easy way to save

Out of the war has come one blessing—a lesson in thrift for millions of those who never before had learned to save.

Enrolled under the Payroll Savings Plan in thousands of factories, offices, and stores, over 27 million American wage earners were purchasing "E" Bonds alone at the rate of about 6 billion dollars worth a year by the time V-J Day arrived.

With War Bond Savings automatically deducted from their wages every week, thrift was "painless" to these wage earners. At the end of the war, many who never before had bank accounts could scarcely believe the savings they held.

The moral was plain to most. Here was a new, easy way to save; one as well suited to the future as to the past. Result: Today, millions of Americans are continuing to buy, through their Payroll Savings Plan, not War Bonds, but their peacetime equivalent—*U. S. Savings Bonds.*

From war to peace! War Bonds are now known as U. S. Savings Bonds, bring the same high return—$25 for every $18.75 at maturity.

Out of pay—into nest eggs! A wage earner can choose his own figure, have it deducted regularly from earnings under Payroll Savings Plan.

New homes to own! Thousands of new homes, like this, will be partially paid for through Bonds wisely accumulated during the next five to ten years.

Keeping cost of living in check! Buying only needed plentiful goods and saving the money which would bid up prices of scarce goods keeps your cost of living from rising. Save *automatically—regularly.*

Weekly Savings	SAVINGS AND INTEREST ACCUMULATED	
	In 1 Year	In 10 Years
$ 3.75	$195.00	$2,163.45
6.25	325.00	3,607.54
7.50	390.00	4,329.02
9.38	487.76	5,416.97
12.50	650.00	7,217.20
15.00	780.00	8,660.42
18.75	975.00	10,828.74

Savings chart. Plan above shows how even modest weekly savings can grow into big figures. Moral: Join your Payroll Savings Plan next payday.

SAVE THE EASY WAY...

BUY YOUR BONDS

THROUGH PAYROLL SAVINGS

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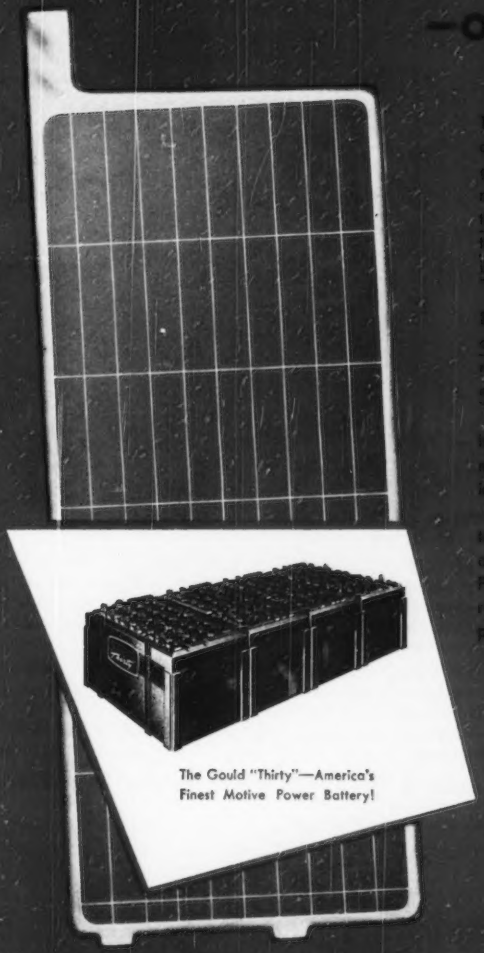

The Gould "Thirty"—America's Finest Motive Power Battery!

To prove that the new progressive solidification and casting techniques employed in the "Z" Plate make the grid 66% more resistant to peroxidation! And why not? Here is the only positive grid in existence that is non-porous and completely solid all the way through—that produces full power throughout long battery life.

This is only one of the reasons why Gould "Z" Plate Batteries stay new longer . . . operate at full capacity more months! Another is a remarkable regenerative active material that renews its energy every day the battery is in use!

This revolutionary "Z" Plate didn't just happen. Its perfection required years of research in Gould's modern laboratories and almost endless testing in Gould's own pilot plant.

Gould "Z" Plate Batteries are so superior to anything heretofore available, you can't afford anything else! Decide NOW on Gould "Z" Plate batteries. Write us outlining your requirements and we will be glad to submit a proposal by return mail.

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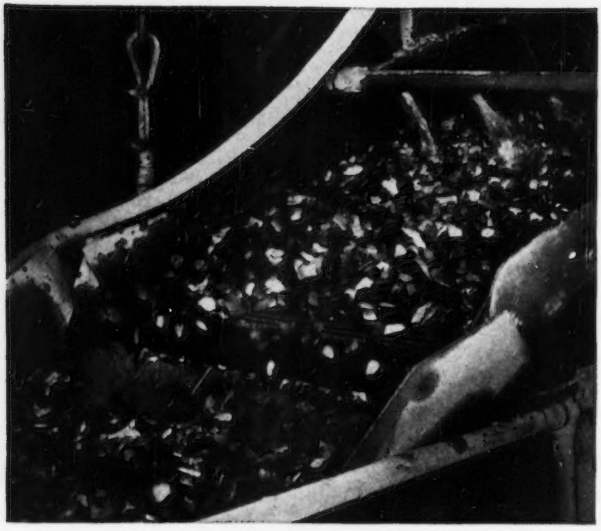

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use Hendrick Perforated Plate on Vibrating and Shaking Screens

Uniformity of mesh *throughout* long service life is an outstanding advantage of Hendrick Perforated Metal Plate; its full clearance obviates clogging, and the easy changing of decks minimizes labor costs. For particularly tough jobs Hendrick Perforated Plate is heat-treated to increase its resistance to abrasion.

Hendrick Perforated Plate is available in any shape of opening — round, square, "squaround," hexagonal, diamond, oval, slotted, tapered — and can be supplied in any required gauge in tank, high carbon, high tensile, and abrasive-resisting steels, and in other commercially rolled metals. It is furnished either flat or corrugated as desired. Write for full information.

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"Rippling Muscles" Construction, is the most apt description of Homocord Conveyor Belt. Each of Homocord's sinews, or strength members, is embedded in muscles of Flexlastics. You can see how this construction dissipates the force of a heavy blow, the constant pounding of heavy material at loading points.

Homocord Conveyor Belt flexes very easily. It troughs much better and runs true in the idlers. These are all factors for longer belt life. Homocord embodies everything you want for heavy mine hauls . . . a cushioned . . . tough . . . flexible . . . mildew-proof conveyor belt that will cut your cost appreciably.

Manhattan also introduced the first long-lift conveyor belt with Rayon Cord Strength Members. Investigate the advantages of RAY-MAN "Tension Master" Conveyor Belt.

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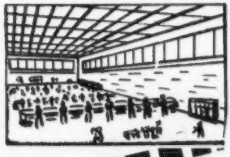

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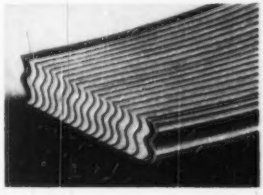

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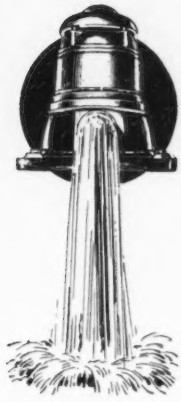

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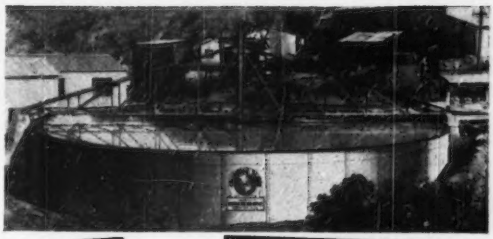

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of this paper

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SAMPLING EQUIPMENT
WILL
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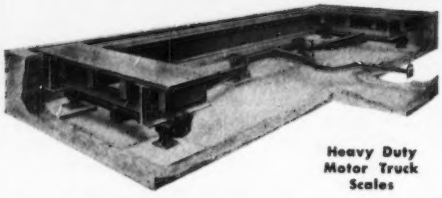

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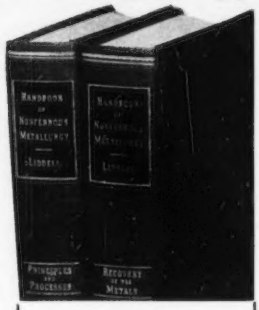

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P 1846, Engineering & Mining Journal
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P 1632, Engineering & Mining Journal,
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ENGINEER EXPERIENCED in design of mine and industrial cars. Give complete qualifications, experience and references, stating age and salary required. Address P. O. Box 2312, Birmingham, Ala.

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MINING GRADUATE now employed as Superintendent of large mine in S. A. Available reasonable notice. Age 34, married, 11 yrs., experience underground, all capacities. Location not important if with family. Details on request. PW-1211, Engineering & Mining Jl.

MILL MAN extensive varied experience flotation, cyanidation, testing, assaying, engineering. B.S. Registered Metallurgical Engr. Competent responsible. Anything in USA or Mexico from assaying to superintending if opportunity for dependable man with wife and child. PW 1736, Engineering & Mining Jl.

MANAGER 20 years progressive, successful foreign and domestic mine operation, extensive knowledge in dealing with mining, metallurgical and administrative problems, speak Spanish, available on consultant or full time engagement. PW 1797, Engineering & Mining Jl.

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For Sale 1800 Acres

Mica and Feldspar Lands in North Carolina 1150 acres in fee, 650 acres in mineral rights. All near Spruce Pine, N. C., on the C. C. & O. RR. Contact Edgar B. Clapp, Bakersville, N. C. Box 156.

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Contractor with excellent equipment and experienced personnel interested in excavating, material handling, or open pit mining work.

CW1319—Engineering & Mining Journal
330 W. 42nd St., New York 18, N. Y.

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640 ACRES PATENTED COAL LAND

60 million tons bituminous coal, reports any public library, U. S. Geol. Su. Bull. 225—Page 240-246. or Deer Creek Coal Field. $15.00 per acre.

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Large engineering firm wishes to acquire several complete plants through purchase of (1) capital stock, (2) assets, (3) machinery and equipment whole or in part. Personnel retained where possible, strictest confidence.

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Mineral Survey 3596-3597, Kennecott Corp. Claims on All Sides at Ray.

WEST END MINING CO.
1921½ Maple Ave., Los Angeles 11, Cal.

WANTED

SLUDGES WANTED

If you have any metallurgical or chemical by-product sludges which may contain rare or minor metals, please contact:

Metallurgical Process Division
Saratoga Laboratories, Inc.
Saratoga Springs, New York

Sludges bought outright or recovery processes developed under contract.

WANTED

Ores and chemicals—any raw materials from owners.

Gertrude A. Meeker
(25 years Mining experience)
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No lengths too long or too short.
Telephone: EAstgate 7-4778

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Export firm interested used Gish-Rooney Earth Resistivity Apparatus willing to pay maximum $200. Instrument should be as modern as possible and in good working condition. Write details.

W-1777, Engineering & Mining Journal
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Detachable Rockbits

All types and sizes.

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APPR. 200 ACRES
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One Block. Near Castle Dome Mine. Sulphide Ore. $15.00 per Acre.

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It costs no more
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CALL WIRE WRITE **CARLYLE**

THE RUBBER HEADQUARTERS

CONVEYOR BELTING, TRANSMISSION BELTING, ELEVATOR BELTING, FIRE, WATER, AIR, STEAM, SUCTION and WELDING HOSE

CARLYLE RUBBER PRODUCTS ARE NEW, GUARANTEED & LOW PRICED

NEW GUARANTEED

CONVEYOR BELTING

ABRASIVE RESISTANT COVERS

Width	Ply	Top-Bottom Covers
48"	8	1/8" — 1/16"
42"	5	1/8" — 1/16"
36"	6	1/8" — 1/16"
30"	6	1/8" — 1/16"
30"	5	1/8" — 1/16"
26"	5	1/8" — 1/32"
24"	5	1/8" — 1/32"
24"	4	1/8" — 1/32"
20"	5	1/8" — 1/32"
20"	4	1/8" — 1/32"
18"	4	1/8" — 1/32"
16"	4	1/8" — 1/32"
14"	4	1/16" — 1/32"
12"	4	1/16" — 1/32"

Inquire For Prices — Mention Size and Lengths

TRANSMISSION BELTING

HEAVY-DUTY FRICTION SURFACE

	Width	Ply	Width	Ply	Width	Ply
Inquire For Prices — Mention Size and Lengths.	18"	6	10"	6	6"	5
	16"	6	10"	5	5"	5
	14"	6	8"	6	4"	5
	12"	6	8"	5	4"	4
	12"	5	6"	6	3"	4

ENDLESS "V"

"A" Width All Sizes —
"B" Width All Sizes —
"C" Width All Sizes —
"D" Width All Sizes —
"E" Width All Sizes —

Sold in Matched Sets.
Inquire For Prices — Mention Size and Lengths.

SPECIAL OFFER . . . HEAVY DUTY RUBBER HOSE

FIRE HOSE

APPROVED SPECIFICATION HOSE EACH LENGTH WITH COUPLINGS ATTACHED

I.D. Size	Length	Per Length
2½"	50 feet	$28.00
	25 "	16.00
2"	50 "	23.00
	25 "	13.00
1½"	50 "	20.00
	25 "	11.00

Specify Thread On Couplings

AIR HOSE

I.D. Size	Length	per Length	Universal Couplings
½"	25 feet	$5.00	$1.50 Pair
	50 "	10.00	1.50 Pair
¾"	25 "	7.50	1.50 Pair
	50 "	15.00	1.50 Pair
1"	25 "	10.00	1.50 Pair
	50 "	20.00	1.50 Pair

LARGER SIZES ALSO AVAILABLE

All Prices—Net — F.O.B. New York

WATER HOSE

I.D. Size	Length	per Length
¾"	25 feet	$4.25
	50 "	8.00
1"	25 "	6.25
	50 "	12.50
1¼"	25 "	7.50
	35 "	10.50
	40 "	12.00
	50 "	15.00
1½"	25 "	10.00
	35 "	14.00
	50 "	20.00

Each Length with Couplings Attached

CARLYLE RUBBER CO., Inc.

62-66 PARK PLACE, NEW YORK 7, N. Y. Phone: BArclay 7-9793

COMPRESSORS: Ingersoll Rand 315 cu. ft., portable, diesel. 2—Steam 19 & 29 x 16 x 26 x 20, 110 lbs. steam pressure. 1—Electric 750 CFM @ 100 lbs., 440 volt, short belt drive.

DIESEL LOCOMOTIVE: Plymouth 25-ton, standard gauge, D-17000 motor, air brakes.

BLAST HOLE DRILLS: Bucyrus Erie 29-T Electric, 440 volt, and one NEW gasoline driven; both with 9" bits and tools. Bucyrus Erie 42-T, electric, 9" bits and tools, built-in wrenches, 220/440 volt.

GYRATORY CRUSHERS: All sizes 8" x 30" to 42" x 134".

JAW CRUSHERS: All sizes 4 x 6 to 48 x 60.

REDUCTION CRUSHERS: Symons 2 ft., 4 ft. and 5½ ft. short head. Telsmith 2 ft. All with or without motor and drive.

DRYERS: Single shell 10' dia. x 20'6" long, complete with all equipment, offered with or without coal firing furnace, dust collector, etc. Located in Minnesota.
1—Ruggles Coles, double shell, class XP12, 80" x 60'.
1—Traylor single shell 60" x 40', with or without motor.
1—Kiln 72" x 42'.
1—Cooler 38" x 46'.

CLASSIFIERS: 2—NEW 78" x 35' Spiral Classifiers, manganese fitted, with tank and 10 H.P. motor, etc., located in Missouri. 1—Alkena 24" x 10'9" with 2 H.P. motor.

SCREENS: Pioneer 5' x 8' Scalper; Robins Gyrex 4' x 7', double deck with motor and drive; Nordberg 5' x 16' Scrubber; and one 4' x 12', 4 deck, flat Screen.

GOODRICH SUPER LONG LIFE CORD CONVEYOR BELT (NEW): Large quantity of Goodrich Belt 42" wide, 6 ply, 42 oz. duck, 7/32" top cover, 1/16" bottom cover, on original reels, all NEW, NATURAL RUBBER, with or without mechanical parts.

MINE HOISTS:
1—All steel, drum 8 ft. dia., 1½" rope, 64,000 lbs. single line pull, 600 FPM, 400 H.P., 2200 volt, A.C., with all control equipment.
1—600 H.P., single drum, 8' x 12', with motor 2200 volt, A.C. and controls.
1—250 H.P., single drum, 7'8" x 5', 30,000 lbs. single line pull, 750 FPM, complete.
1—200 H.P., single drum, 42" face, 60" dia., A.C., 2200 volt and control.
1—150 H.P., double drum, 34" dia., 42" face, 440 volt, A.C., complete with controls.

A. J. O'NEILL
Lansdowne Theatre Building
LANSDOWNE, PA.
Phila. Phones: Madison 3-8300 - 3-8301

AIR COMPRESSORS
9 Electric 5000, 3176, 2200, 1528 & 1302 ft.
6 Diesel 1578, 1000, 676 & 500 ft.
LOCOMOTIVES
7 Diesel 80, 65, 45, 30 & 20 Ton.
22 Gas, 35, 25, 16, 12, 8 & 6 Ton.
R. R. CARS
150 Dump Cars, 2, 4, 12, 20 and 30 Yd.
100—50-Ton Flat Cars, 66—50-Ton Gondolas.
150—8,000 & 10,000 Gal. Cap. Tank Cars.
TUNNEL MUCKERS — LOADERS
4 Gardner Denver GD9 & GD14.
10 Elmco 12B & 21, 4 Sullivan HL20.
LARGE JAW CRUSHERS
7—60x84, 40x48, 36x42 & 24x36.
ROTARY DRYERS & KILNS
70" x 35' Indirect Ruggles Coles XB-10.
80" x 60' Ruggles Coles XF-12.
4' x 20' Ruggles Coles XA-2.
Single Shell Direct 4 x 30, 5 x 35, 5 x 40, 5 x 50, 5½ x 40, 6 x 20, 6 x 28, 6 x 30 & 6 x 60.
Kilns 5 x 50, 7'6" x 125, 6 x 60.
BALL, ROD & TUBE MILLS
6' x 48" Hardinge Conical Ball Mill.
5' x 22" Hardinge Conical Ball Mill.
4x10, 6x6 & 7x5 Cylindrical Ball Mills.
7' x 18' Allis Chalmers 2 Compartment Mill.
6x14 Hardinge Classifier.
36" & 78" Spiral and 4' Dorr Rake Classifier.
3x8, 4x10 & 7x9 Rod Mills, Marcy, Hardinge.
5 x 22 Allis Chalmers Tube Mill.
4 x 16 & 5½ x 20 Tube Mills, Steel & Silex Lined.
PULVERIZERS
2—1½ Sturtevant Ring Roll Mill.
6' x 48' Hardinge Mill with Air Classifier.
4 & 5 Roll Low Side Raymond Mills.
2—1 Raymond Automatic Pulverizers.
STANHOPE, 60 E. 42nd St., New York 17, N. Y.

Rotary Kilns—6½' x 70' & smaller. One 9' x 170'.
Rotary Dryers—3' x 30'—4' x 30'—6' x 40'—8½' x 50'—8½' x 60'—8' x 70'—7' x 60'.
Tube & Ball Mills—6' x 9'—5' x 22'—8½' x 10-7'.
Fuller-Lehigh Mills—22"—47" & 52"—Bradley Mills.
Jaw Crushers—From 10" x 6" up to 38" x 24".
Crushing Rolls—From 18" x 10" up to 72" x 20".
1—7" Newhouse Crusher, latest type.
Sturtevant Rotary fine crushers—No. 0—No. 1—No. 1½ and No. 2.
Ring Roll Mills—Sturtevant No. 1—No. 2.
8'—14' air separators.
Magnetic separators—jigs—screens—classifiers and thickeners.
5', 6' & 7' dia. Rod Mills.
Mine Hoists.
One 4 roll Raymond Mill, low side.
8' x 10'—8' x 12'—11½' x 19' Rotary Filters.

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For Sale

Complete 75-ton lead-zinc flotation plant with auxiliary equipment, concentrating tables, 150-ft. 18-in. belt conveyor, 2-drum dragline hoist with scraper with 25-h.p. motor, 3 x 6-ft. Tyler Niagara screen and other items.

Chestnut Hill Zinc Company
Box 1026 Galena, Illinois

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All Sizes
Track Accessories

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***Genl. Office:* 212 Victor St.**
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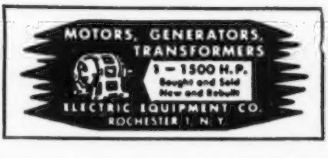

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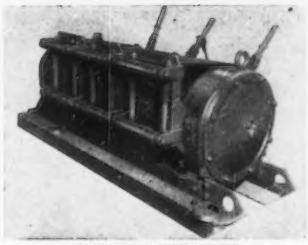
COMPRESSORS

1—80 CFM Worthington, 6"x5".
1—131 CFM Chicago Pneumatic, 8½" and 4⅝"x5".
1—139 CFM Chicago-Pneumatic, 8¾" and 4⅝"x5".
1—194 CFM Gardner-Denver 7" and 5⅜"x5".
1—284 CFM Ingersoll-Rand, 6 cyl., 6" and 5"x5".
2—293 CFM Ingersoll-Rand, 12" & 6½"x10".
1—315 CFM Ingersoll-Rand, 6 cyl., 7" and 6¾"x5".
1—382 CFM Chicago-Pneumatic, 4 cyl., 9¾" and 5½"x5½".
1—447 CFM Ingersoll-Rand, 14" & 7½"x12".
1—528 CFM Ingersoll-Rand, 14"x12".
1—637 CFM Sullivan angle compound, 14" and 8¾"x10".
1—800 CFM Ingersoll-Rand 18" & 11"x16".
1—888 CFM Ingersoll-Rand, 19" & 12"x16".
1—105 CFM Schramm portable straight line, 3-13/16"x4½", driven by Buda gas engine, trailer mounted on 4 pneu. tires.
1—210 CFM Jaeger portable, 5" & 4½"x4", driven by Continental gas engine, trailer mounted on 4 pneumatic rubber tires.
1—210 CFM Worthington portable "Blue Brute", 6" & 5⅜"x4½", driven by Continental gas engine, trailer mounted on 4 steel wheels.
2—310 CFM Gardner-Denver portable, 6"x 5½", driven by Buda Gas Engine.
1—153 CFM Ingersoll-Rand low pressure, 9"x6".
1—273 CFM Ingersoll-Rand low pressure, 12"x6".
1—698 CFM Union low pressure, 16"x12".
1—840 CFM Laidlaw duplex low pressure, 13"x10".



BALL AND ROD MILLS

1—36"x24" New Morse Bros. Batch Mill.
1—4'x4' New Ball Mill.
1—4'x4' Deweo Ball Mill.
2—6'x36" Hardinge Conical Ball Mills.
1—6'x48" Hardinge Conical Ball Mill.
1—6'x8' Marcy Ball Mill.
1—8'x22" Hardinge Conical Pebble Mill.
1—3'x8' Denver Eng. Works Tube Mill.
1—3'x8' Ruth Rod Mill.
1—5'x36" Hardinge Conical Ball Mill.
1—64½ Marcy Ball Mill.

CLASSIFIERS

1—36"x20' Dorr Duplex Rake Classifier.
1—54"x16' Morse "Trueline" Rake Classifier.
1—8' bowl attachment from Dorr 27" simplex Classifier.
3—"st. Joe" type Hydraulic Classifiers, 10 cells, 20 spigots.
1—24"x8' Akins Classifier.

FILTERS

1—3'x2' Morse all metal drum Filter.
1—3'x4' Oliver drum Filter.
1—4'x3' disc Morse Filter.
2—6'x2' disc American Filters.
1—6'x3' disc American Filter.

TUGGER HOISTS

5—I-R size EU "Utility" air hoists, single drum.
1—I-R size A-4NN-OJ2 drum air hoist.
1—Sullivan RH 5 HP single drum electric slusher hoist.
1—Sullivan RH 7½ HP single drum electric slusher hoist.
2—I-R size 107, 7½ HP single drum electric slusher hoists.
1—I-R size 5NN-OH 5 HP double drum electric slusher hoist.
1—I-R size 20-MNM-2D 20 HP three drum electric slusher hoist.
1—Sullivan model B-211 25 HP double drum electric slusher hoist.
3—Sullivan type HE 6½ HP D.C. single drum electric hoists.
9—Sullivan type HDE 6½ HP D.C. double drum electric hoists.

JAW CRUSHERS

3—4"x6" new Morse Jaw Crushers.
2—8"x8" Universal Semi-Steel Crusher.
1—8"x12" Universal Semi-Steel Crusher.
1—8"x24" Rogers Cast Steel Crusher.
1—9"x15" Farrell Blake type.
1—9"x16" Cedar Rapids All-Steel Crusher.
1—9"x16" New Morse Crusher.
1—9"x21" Telsmith Jaw Crushers.
1—8"x36" Universal All-Steel Crusher.
1—9"x36" Cedar Rapids.
1—13"x20" Universal All-Steel Crusher.
1—10"x24" Allis-Chalmers Jaw Crusher.
1—24"x36" Traylor "Type A."

BETTER MACHINERY—IT'S FULLY RECONDITIONED

ESTABLISHED 1898

MORSE BROS. MACHINERY CO.

P.O. BOX 1708 DENVER, COLORADO, U. S. A. CABLE "MORSE

COMPLETE ORE-MILLING PLANTS — FLOTATION · CONCENTRATION · MACHINERY · CYANIDE · AMALGAMATION

General Office and Plant: 2900 BRIGHTON BLVD., DENVER, COLO.

BALL MILLS

3—2'86 Marcy w/225 HP Motors.
1—2'76 Marcy.
1—2'79 Traylor w/200 HP Motor.
1—5 x 6 C.I.W. w/100 HP Motor.
2—5 x 8 Denver tube.
2—5 x 13 Denver tube.
1—5½ x 18 Marcy tube.
1—4 x 5 Allis-Chalmers ball.

CLASSIFIERS

2—Dorr Rake 5' x 23'6", excellent condition.
1—Akins Spiral 4' x 15'.
1—Wemco screw 60" x 20'3" w/5 HP gearmotor.
1—Dorr bowl type QSSB, 15' dia.

CONVEYORS & FEEDERS

1—Link Belt pan feeder, new 36" x 6'8" with 2 HP gearmotor, self-contained type.
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HOISTS

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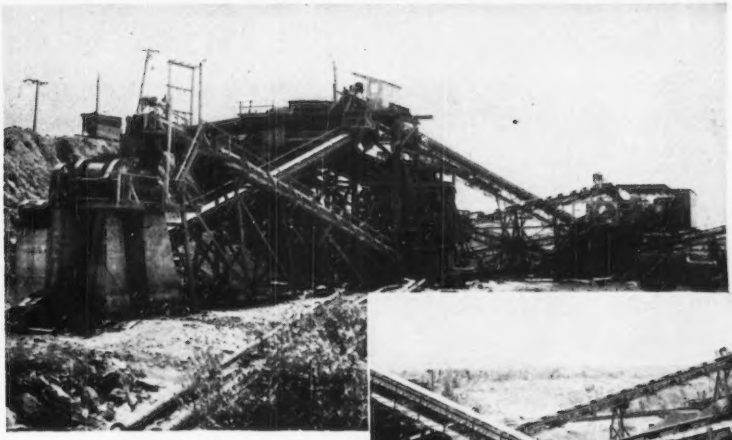

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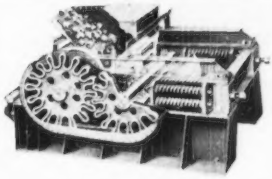

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1¼"	1.660	1.380	200 lbs.	0.27 lbs.	300 ft. coils
1½"	1.900	1.610	200 lbs.	0.32 lbs.	250 ft. coils
2"	2.378	2.070	170 lbs.	0.44 lbs.	200 ft. coils
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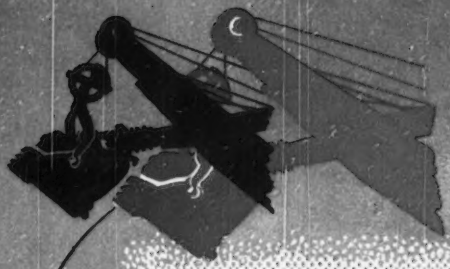

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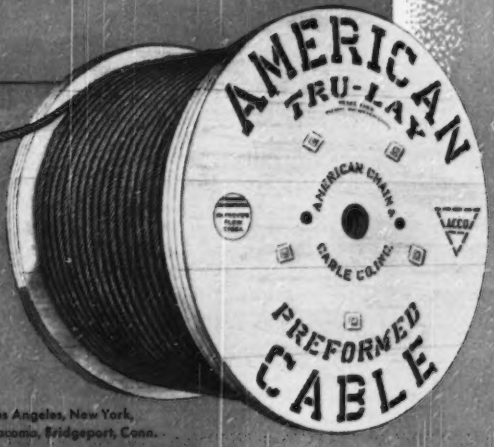

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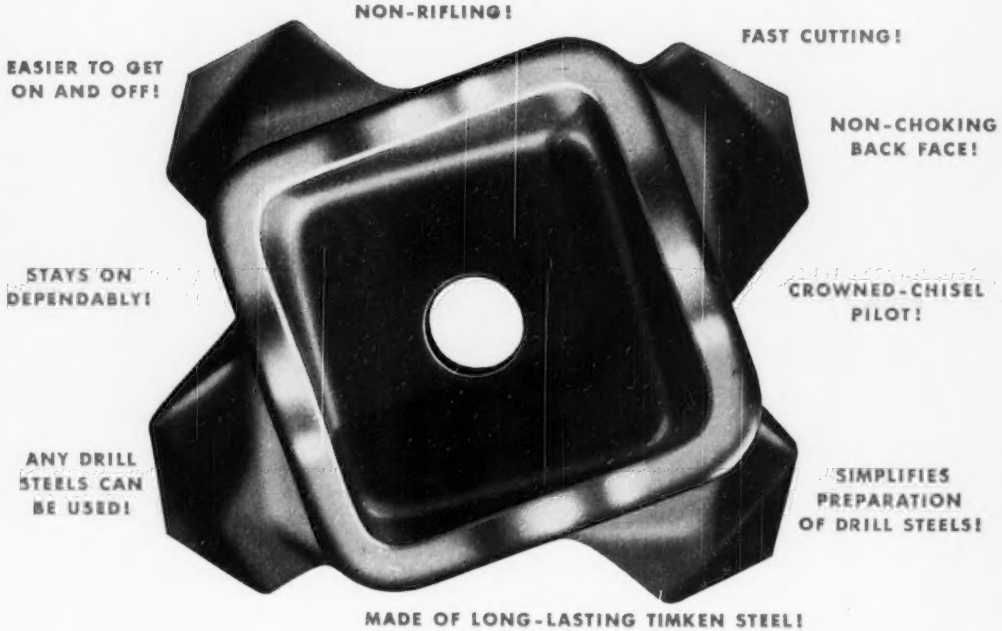

A NEW one-use rock bit developed by The Timken Roller Bearing Company offers you special advantages that can't be equalled by any other one-use bit. It's the revolutionary Timken® one-use "Spiralock" bit!

The new bit has a unique "Spiralock" union—a square socket that spirals slightly as it recedes. The superiority of this union has been proved under actual on-the-job conditions.

The bit stays on dependably in the hole. Yet it's easier to get on and off. Just a few blows of the drill and it's on; just a few blows of a hammer and it's off. Steels last much longer, are easier to prepare and recondition. Existing drill steels of any size and section can be adapted easily and quickly.

Other great advantages of the new bit are: Fast-cutting design. Crowned chisel pilot for easier starting and "collaring." "X" cutting edge that prevents rifling in any ground. Non-choking back face, scalloped and rounded off to prevent chips packing behind the bit. And because it's made of Timken electric furnace steel, the "Spiralock" bit has a long life.

The new one-use "Spiralock" bit—designed for drilling jobs where bit reconditioning is impractical or undesirable—is the latest addition to the Timken rock bit line, which includes the famous threaded multi-use bit and threaded carbide insert bit. And Timken is the only company that offers you *all three* types.

For help in selecting the right bit for your job, call on our rock bit engineering service. Write to The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO".

TIMKEN

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ROCK BITS

Your best bet for the best bit for every job

1 Timken threaded multi-use rock bit.

2 Timken threaded carbide insert rock bit.

3 Timken one-use "Spiralock" rock bit.